Port of Seattle Submittal
For RFA 6-26-93

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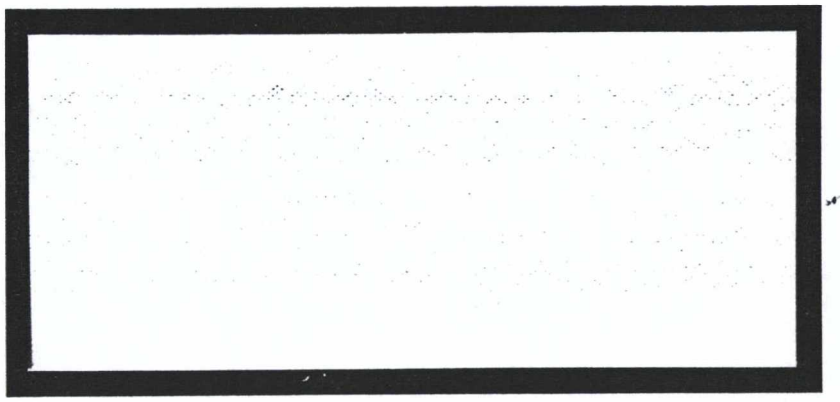

Environmental Resources Management

PRELIMINARY UNDERGROUND TANK ASSESSMENT

Prepared for:

Port of Seattle

SEPTEMBER 1990

Prepared by:

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JOB NO. 64001.00
September 20, 1990

Mr. David A. Aggerholm
Manager, Environmental Management Engineering Department
Port of Seattle
P.O. Box 1209
Seattle, WA 98111

Subject: Preliminary Underground Tank Assessment

Dear Mr. Aggerholm:

The accompanying final report presents findings, conclusions, and recommendations developed as a result of this Preliminary Tank Assessment performed for the Port of Seattle by ERM-Northwest, Inc.

A total of seven sites containing 24 underground storage tanks were investigated. In addition, the analytical results from sixteen tanks assessed by the Port of Seattle were reviewed by ERM-Northwest. This report also summarizes these findings and presents conclusions.

ERM-Northwest has enjoyed providing the Port of Seattle with environmental consulting services and establishing a professional relationship with Port personnel. We look forward to working with you and your staff on subsequent projects.

Sincerely,

Michael K. Bacon
President

Michael D. Nalley
Project Manager

Fred H. Becker, P.G.
Project Geologist

cc: Ms. Elizabeth Stetz
Mr. Douglas Hotchkiss
Mr. Joe Hickey

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The ERM Group

Addendum to the Appendix B

Erratum:

Pursuant to POS clarification, ERM-NW soil sample I.D. Nos. D1-B, D1-C and D2-A are respectively interchanged with DD1-B, DD1-C and DD2-A. The narrative, Table 7-1 and Figures 7-2 and 7-3 of section 7 represent the report areas so changed.

The ERM Group

Executive Summary

In May of 1990, the Port of Seattle (POS) retained ERM-Northwest (ERM-NW) to assess environmental subsurface site conditions for 24 underground storage tank areas located at eight POS owned properties. The properties are located as follows: Shilshole Bay Marina; Fisherman's Terminal; Pier 66; Terminal 91; Terminal 18; The Horton Street Maintenance Shop; and the PanAm Terminal and the Sea-Tac Fire Department, both located at the Seattle-Tacoma International Airport. The purpose of the assessment activities was to characterize the environmental condition of the tank areas and compile the collected data into a detailed collection of soil and groundwater information necessary to guide future remedial actions.

ERM-NW was also retained to evaluate POS field documentation and analytical laboratory results for an additional 16 tank areas. These tank areas are located on the following POS properties: Terminal 91; Fisherman's Terminal; Terminal 18; Terminal 30; Terminal 106 and Terminal 15.

The tank assessment activities included the application of geophysical techniques, the drilling of 58 soil borings, and the collection of approximately 164 soil samples. Select soil samples were subjected to laboratory chemical analyses to identify contaminants in the subsurface media.

The data collected and the information obtained indicates that 19 tank areas possess chemical contaminants which exceed the Model Toxics Control Act (MTCA) compliance cleanup levels. Table 1 presents soil cleanup levels promulgated by the proposed MTCA cleanup standards dated July 1990. This table also lists the hazardous constituents of concern and associated cleanup levels. Table 2 identifies the tank areas exceeding MTCA limits and the associated POS facility locations.

The limitations of the assessment activities performed both by ERM-NW and POS prevents the determination of the complete extent of the identified chemical contaminants in the areas of study. However, based on the information obtained, vertical delineations of soil contamination have been estimated.

A review of Port of Seattle's 1990 Tank Program indicates that all of the tanks assessed by ERM-NW are scheduled for removal. It is recommended that during tank removals, a more complete assessment of soil surrounding these tanks be performed. However, in those areas which may not be immediately scheduled for removal, tank pressure testing may be conducted to ascertain the potential source of contamination determined by the study.

The data obtained and reviewed by ERM-NW indicates that potential ground water contaminants exist at all of the facilities within this scope of study, excluding the two properties located at Seattle-Tacoma International Airport. It is recommended that a complete delineation of possible ground water impairment in the above tank areas be performed.

TABLE I

Method A Industrial Soil Cleanup Levels - Industrial Soil

Hazardous Substance	CAS Number	Cleanup Level
Benzene	71-43-2	0.5 mg/kg
Ethylbenzene	100-41-4	20.0 mg/kg
Toluene	108-88-3	40.0 mg/kg
Xylenes	1330-20-7	20.0 mg/kg
PCB Mixtures	87-86-5	10.0 mg/kg
TPH (gasoline)		100.0 mg/kg
TPH (diesel)		200.0 mg/kg
TPH (other)		200.0 mg/kg

Reference: Model Toxics Control Act Cleanup Regulations and Proposed Amendments, Chapter 173-340 WAC July, 1990.

TABLE II

Tank Areas Exceeding MTCA Limits

Terminal 91	Tank A Tank B Tank G Tank N
Fisherman's Terminal	Tank G Tank L
Shilshole Bay Marina	Tank M-1 Tank M-2 Tank M-3 Tank h Tank n
Terminal 18	Tank P
Pier 66	Tank D
SeaTac Pan Am Hangar	Tank 10F
Terminal 30	Tank 30a Tank 30aa
Terminal 106	Tank we Tank wc
Horton Street Maintenance Shop	Tank CW-100d

SECTION 1

Introduction

In May of 1990, the Port of Seattle (POS) retained ERM-Northwest (ERM-NW) to assess the environmental subsurface site conditions of 24 underground storage tank areas located at eight POS owned properties. The properties are located as follows: Shilshole Bay Marina; Fisherman's Terminal; Pier 66; Terminal 91; Terminal 18; the Horton Street Maintenance Shop; and the PanAm Terminal and the Sea-Tac Fire Department, both located at the Seattle-Tacoma International Airport.

The assessment activities were conducted to characterize the environmental condition of the underground storage tanks and to ascertain the presence or absence of chemical compounds in the subsurface media. Information obtained from the soil boring and sampling program, and the results of analytical laboratory results, have been compiled in the following report for present use and to guide future remedial actions.

The tank assessment activities included the application of geophysical techniques, the drilling of 58 soil borings and the collection of approximately 164 soil samples. POS field documentation and analytical laboratory results for an additional 16 tank areas were evaluated and incorporated into the enclosed report. These tank areas are located on the following POS properties: Terminal 91 (five tank areas), Fisherman's Terminal (1 tank area), Terminal 18 (two tank areas), Terminal 30 (two tank areas), Terminal 106 (four tank area) and Terminal 115 (two tank areas).

Summary of Field Procedures

Geophysical Survey

A geophysical survey was conducted from May 30 through June 1, 1990 at each of the seven POS sites. The geophysical technique used in this project was Ground Penetration Radar (GPR). The GPR equipment was operated and monitored by an experienced ERM geophysicist.

The purpose of the survey was to verify the absence or presence of buried utilities (such as water lines, electrical lines, sewer lines and cables) and to determine the soil boring locations in specified POS tank areas.

GPR is often used to map shallow stratigraphy and define buried objects by radiating high frequency radio waves downward into the

subsurface. Reflections from interfaces of materials having different electrical properties such as pipes and tanks are received by the antennae, and are transmitted to a graph recorder. This recorder produces continuous cross sections as the transmitting/receiving antennae are slowly moved across the ground surface. The equipment used during this particular survey was manufactured by Geophysical Survey Systems, Inc. The system included a profiling recorder which supplies power and synchronizing signals to a transducer which produces the pulse of electromagnetic energy.

GPR survey lines were placed in the vicinity of the underground storage tanks to enable test borings to be located as close to the tanks as possible, without encountering the underlying tanks or buried utilities. Typically, the survey procedure consisted of running a survey line over the tank to confirm the tank location. Subsequent survey lines were then traversed around the perimeter of the tank location to ensure that buried utilities were not present. If a buried pipe or cable was detected, subsequent parallel and perpendicular survey lines were traversed to define the orientation of the utility.

At least two lines, and as many as five or more lines, were traversed at each tank location. The data were interpreted in the field by the ERM geophysicist. Boring locations were determined on the basis of the graphs produced by the GPR. These boring locations were then marked in the field with spray paint.

Health and Safety

Prior to the drilling operations, a health and safety meeting was conducted which included the ERM-NW project manager and the drilling subcontractor. The meeting consisted of outlining the goals and objectives of the POS preliminary tank assessment project and reviewing salient information presented in the ERM-NW health and safety plan. The health and safety plan was prepared by the project manager and Christian Houck, Health and Safety Officer at ERM-NW. At the conclusion of the meeting, the drilling subcontractor personnel and the project manager signed the health and safety plan, acknowledging the potential liabilities and the necessary precautionary measures. A complete copy of the health and safety plan is presented in Appendix A.

Field Monitoring

During the field activities, an organic vapor analyzer (OVA) was used to monitor the air at the borehole and the ambient air in the breathing zone of the personnel working around the drill rig. The OVA detects the presence of volatile organic compounds in the air, and displays the concentrations in parts per million (ppm). The analytical instrument selected for use at this site was the Century OVA

manufactured by the Foxboro Company. The OVA 128 was also used to prescreen some of the soil samples prior to laboratory analysis.

Soil Boring and Sampling Program

ERM-NW conducted a subsurface soil boring program, beginning June 14 and concluding on July 5 of this year. The boring program was conducted at 24 POS owned tank locations and consisted of fifty-eight soil borings ranging in total depths of 4.5 to 24 feet below the existing ground surface. The drilling was achieved utilizing an 8" diameter hollow stem auger attached to a model B-61 Mobile® Drill rig. Hokkaido Drilling was contracted to conduct the drilling operations.

Soil grab samples were generally collected at approximately 5 foot intervals to total depth. The samples were obtained by driving an 18 inch core tube with a 140 pound hammer. Subsequent to sample collection the soil was immediately contained in 4 and 8 ounce jars with teflon lids, labeled, sealed in plastic bags and immediately placed in an insulated cooler with frozen blue ice for transport to Alden Analytical Laboratory.

All drilling and sampling equipment was decontaminated prior to each boring and sampling effort. The drilling equipment was steam cleaned. The sampling utensil consisted of a stainless steel spoon and was decontaminated with a tap water and alconox detergent, followed by a tap water rinse and then a final rinse with distilled water.

Analytical Procedures

Thin Layer Chromatography Analysis

Thin Layer Chromatography (TLC) was used to prescreen soil samples collected from diesel and waste oil tank locations in order to verify the presence or absence of these constituent contaminants. The results of the TLC test were used to select samples for further laboratory analysis. In this manner, soil samples which may not have otherwise been selected for laboratory analysis could be identified as possessing contamination and thus be analyzed for quantitative as well as qualitative identification of the contaminant.

TLC is an established analytical technique which has been widely used in the past as a qualitative tool in the chemical industry. This method meets many of the analytical needs of hazardous waste site investigations and excavations. TLC is useful for detection of both semi-volatile and non-volatile organic compounds, making it

especially useful for determining the presence of low levels of diesel fuels and waste oil in soil and groundwater.

Chemical Analysis

The analytical laboratory retained for this project was Alden Analytical Laboratories, Inc. of Seattle. The Alden Laboratory reports are presented in Appendix B. The EPA test methodologies implemented in identifying and quantifying chemical content included the following:

- Total Extractable Petroleum Hydrocarbons(TEPH), EPA Test Method 8015 - modified;
- Total Petroleum Hydrocarbon (TPH), EPA Test Method 418.1; and
- Aromatic Volatile Organic Compounds-Benzene, Toluene, Ethylbenzene and Xylene (BTEX), EPA Test Method 8020.

Gasoline products were typically analyzed using the EPA 8015 modified and EPA 8020 analyses. Waste oils and diesel fuels were typically analyzed using the EPA 418.1 analysis.

Select samples were also analyzed for Volatile Organic Compounds (VOCs) using EPA Test Method 8240 and Polychlorinated Biphenyls (PCBs) using EPA Test Method 8080.

In addition, Laucks Laboratory was retained to perform chemical analyses on soil samples collected during POS's in house tank assessment activities. The analytical reports prepared by Laucks Laboratory are presented in Appendix C.

SECTION 2

Terminal 91

Site Location

Terminal 91 (T-91) is located at the north end of Elliot Bay, west of 15th Avenue in the Interbay area of Seattle between Queen Anne and Magnolia. The project activities were conducted at the DAS area (Tanks A,B andC) and adjacent to the T-91 control tower (Tank K). The general site location is shown on the Vicinity Map, Figure 2-1.

Site Procedures

The preliminary tank assessment activities at T-91 were performed on June 14th, 16th, 22nd and 26th of this year. Four tanks were assessed at T-91. The POS tank designations are listed below along with associated capacities and content.

Tank A - 2,000 gallon gasoline tank
Tank B - 7,000 gallon unleaded gasoline tank
Tank C - 10,000 unleaded gasoline tank
Tank K - 500 gallon heating oil tank.

A total of 16 soil borings were drilled at the above mentioned Terminal 91 facility areas. The depth of the borings ranged from 7.5 to 19 feet below ground surface.

Three soil borings were drilled at Tank B and three at Tank C to assess soil conditions. In the area of Tank A, eight borings were drilled with three placed around the Tank G area. Tank G is located immediately adjacent to and west of Tank A. It was necessary to place additional borings around Tank G to fully assess the conditions at Tank A. Two soil borings were placed adjacent to Tank K. Figures 2-2, 2-3 and 2-4 depict the boring locations and tank areas.

Site Conditions

The boring logs attached at the conclusion of this section indicate that the soils encountered were consistent in this area of study. The uppermost layer consisted of a surface layer of dry fill sand approximately two feet thick. Underlying the fill soil was a loose to medium dense sand and silty sand interlayered with thin beds of stiff saturated sandy clay and/or silt. The soils are typical of the hydraulically placed fill soils used to raise supratidal areas along the

Seattle coastline. In addition, ground water was encountered at depths ranging from 6 to 12.5 feet below ground surface.

Hydrocarbon odors and OVA readings were encountered at each of the Tank locations. For Tank B, OVA readings of 500 ppm or greater were encountered in boring T91B-1. Boring T91B-2 and T91B-3 had lesser amounts of both odors and OVA readings. No odor was detected in soils excavated adjacent to Tank C. OVA readings of 50 ppm or less were also noted for Tank C soils. Tank A typically had OVA readings of 1000 ppm or greater, with associated mild to strong odor.

The soils encountered around Tank K were typically a gravelly and cobbly silty sand, interlayered with sandy silt, overlain by one to two feet of fill sand. The ground water level at Tank K occurred between 8 and 10 feet. No odors or significant OVA readings were detected.

Analytical Results

The analytical results obtained from soil samples submitted for chemical analysis from Terminal 91 Tanks A, B, C and K, all exhibited detectable levels of either TEPH or TPH. The sample results are summarized in Table 2-1.

Tank A

Samples collected from borings adjacent to Tank A yielded levels of TEPH ranging from 9 mg/kg in T91A6-B (14 feet below surface) to 510 mg/kg in T91A3-B (9 feet below surface). Sample T91A1-B (7.5 feet below surface) yielded a TPH level of 910 mg/kg. The concentrations of T91A3-B and T91A6-B exceed the proposed MTCA limits.

Specific constituents of gasoline (benzene and xylene) were detected from the following samples collected at depths of 9 feet below ground surface.

- T91A2-B - 1400 µg/kg (benzene)
- T91A3-B -1900 µg/kg (benzene) and 26,700 µg/kg (xylene)

The above results exceed the proposed MTCA limits of 500 µg/kg for benzene and 20,000 µg/kg for xylene.

Tanks B, C and K

TEPH concentrations for samples collected adjacent to the Tank B area range from 8.1 mg/kg to 26 mg/kg. Soil samples collected at Tank C possessed TEPH concentrations ranging from 5.1 mg/kg to 13

mg/kg. Both soil samples obtained from Tank K yielded trace levels of TEPH.

Conclusions

The analytical laboratory results for soils at Tank K indicate that trace levels of TEPH exist in samples collected at 7.5 and 14 feet below ground surface.

The analytical laboratory results indicate that low levels of TEPH exist in the upper 10 feet of soil around Tanks B and C.

The field observations and analytical results indicate that significant soil contamination at Tank A occurs on the east, west and south sides of the tank and extends downward to a depth of about nine feet. This is below the observed depth of ground water, which was encountered at 8 feet. Elevated concentrations of TEPH, benzene and xylene above the proposed MTCA limits were detected in this zone. Based on these findings, it is likely that ground water impairment exists.

Summary of POS Tank Assessment

POS personnel conducted a soil excavation and sampling program collected to assess subsurface conditions adjacent Terminal 91 Tanks D, E ,F ,G and N in August of 1989. Tank areas D, E, and F are situated immediately east of the DAS tank area assessed by ERM-NW. Tank N is located at the NE corner of the old City Ice building.

Tanks D, E and F are 10,000 gallon diesel tanks. Tank G is a 10,000 gallon gasoline tank and Tank N, a 650 gallon diesel tank.

POS personnel excavated along the tank areas using a backhoe. Samples were collected at or just above the ground water table. The depth at which the samples were collected was (noted by the sampler) approximately eight feet below ground surface. In addtion, the material encountered was as described in the ERM-NW portion of this section.

POS Analytical Results

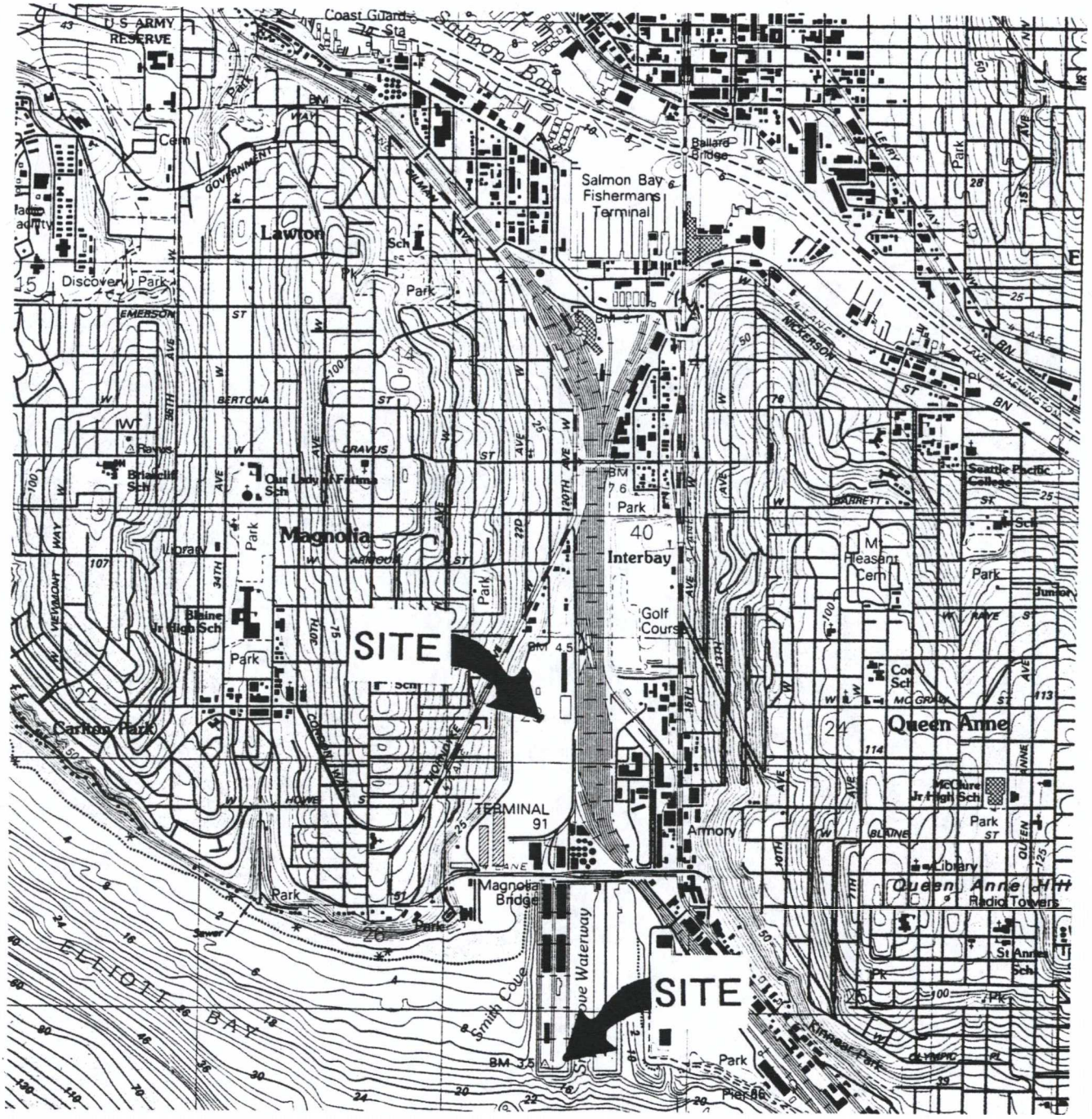
The analytical results indicate levels of TPH (oil and grease) detected in soil samples collected from trenches excavated adjacent to Tanks D, E, and F ranged from 22 mg/kg to 140 mg/kg. These concentrations are within proposed MTCA limits.

The analytical results indicate soil contamination at Tank G. Both TPH and xylene levels are above the proposed MTCA limits for soil cleanup in Sample 23-3. The levels are 810 mg/kg and 82,000 µg/kg, respectively. Levels within proposed MTCA limits for toluene, ethylbenzene and xylene were detected in Sample 23-2. Table 2-1 summarizes these analytical results.

Conclusions

The analytical results indicate soil and ground water contamination resulting from releases of Tanks G and N. The subsurface conditions of Tanks G and N may also be a result from other adjacent tank areas. In addition, some impairment of soil below current WDOE guidelines was also detected around Tanks D, E, and F.

FIGURE 2-1
VICINITY MAP
TERMINAL 91



Source: 1983 USGS
Seattle North Quadrangle

State of Washington

Scale 1:25 000

N

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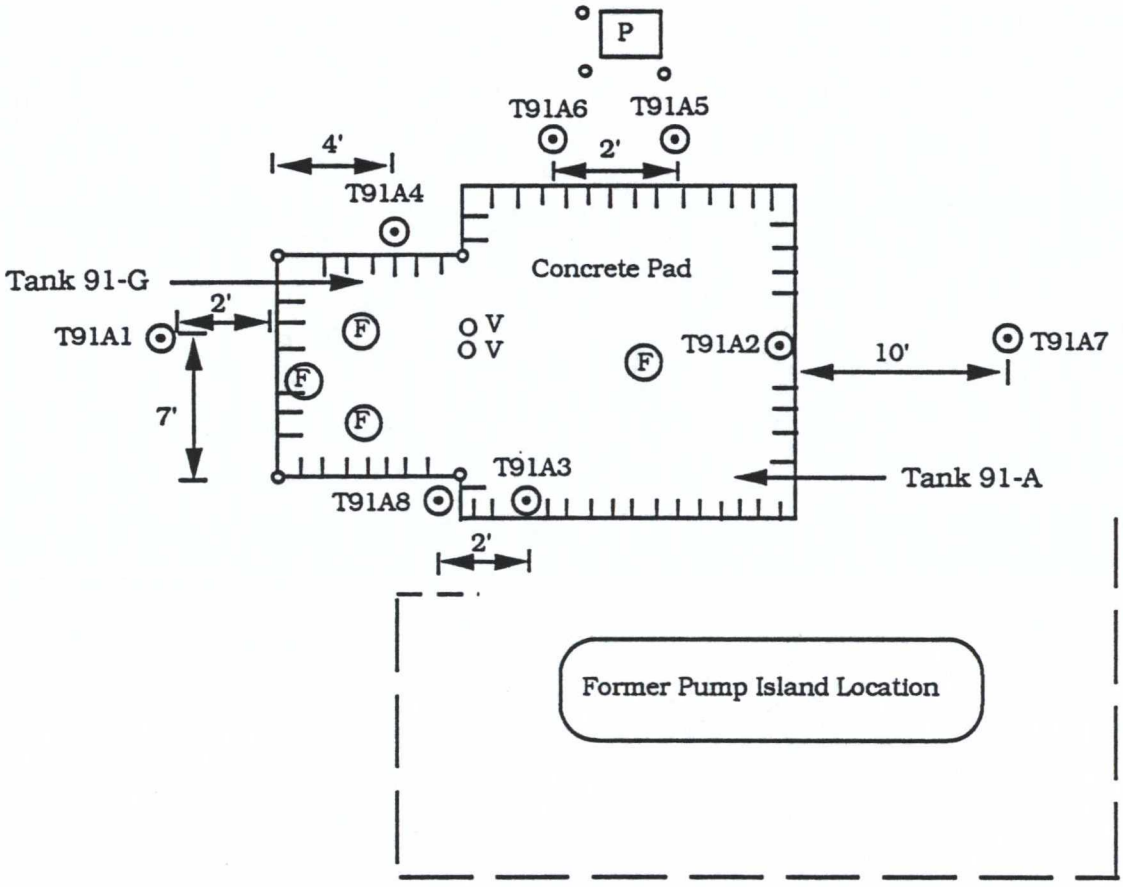
FIGURE 2-2
SITE MAP
TERMINAL 91
TANK 91-A



Note: A4, A5, and A6 are located one foot North of concrete pad.

Legend

- V Vent Pipe
- F Fill Port
- Boring Location
- Bumper Guard
- P Pump

N

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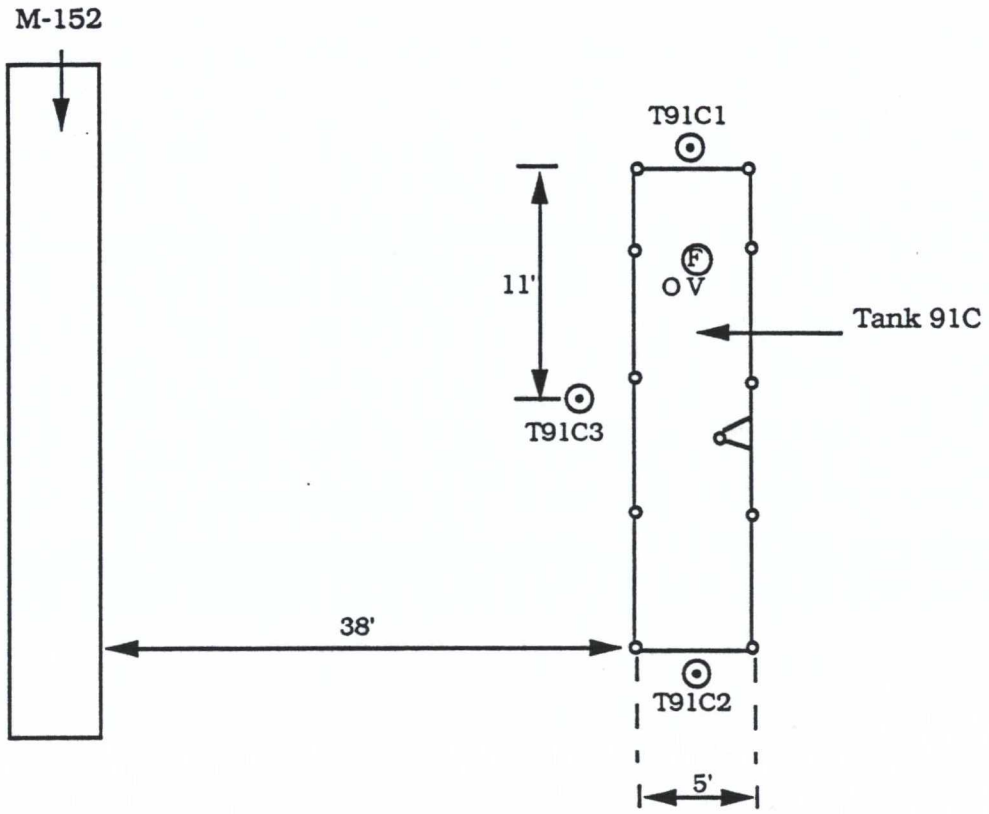
FIGURE 2-4
SITE MAP

TERMINAL 91
TANK 91-C



Note: T91C3 is located one foot East of concrete pad. C1 and C2 are located one foot North and South of concrete pad respectively.

Legend

- Bumper Guard
- Boring Location
- OV Vent Pipe
- F Fill Port

N

NOT TO SCALE

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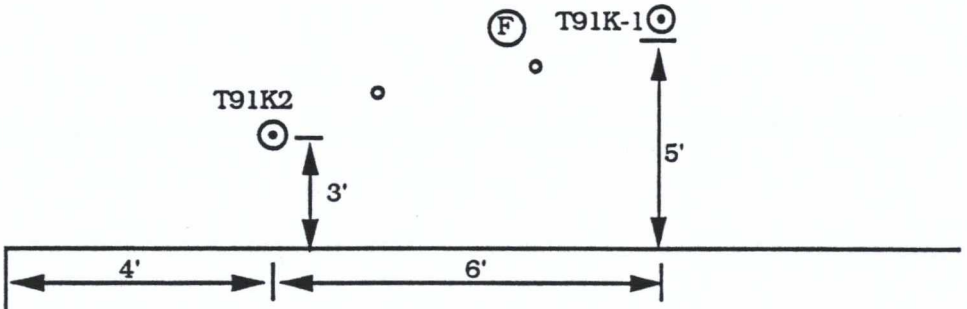
FIGURE 2-5
SITE MAP
TERMINAL 91
TANK 91-K



POS Control Tower

Legend

- Bumper Guard
- Boring Locaiton
- (F) Fill Cap

N

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TABLE 2-1
Analytical Results for Terminal 91

Tank Designation: T-91A

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
T-91-A1-B	6-7.5	910.0*
T-91-A4-B	6-7.5	28.0

Tank Designation: T-91A, B, and C

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
T-91-A2-B	7.5-9	24.0
T-91-A3-B	7.5-9	510.0*
T-91-A5-B	7.5-9	72.0
T-91-A6-B	12.5-14	9.1
T-91-A8-B	12.5-14	17.0
T-91-B1-B	7.5-9	26.0
T-91-B2-B	7.5-9	25.0
T-91-B2-C	12.5-14	8.1
T-91-B3-B	7.5-9	11.0
T-91-C1-C	12.5-14	13.0
T-91-C2-B	7.5-9	5.1
T-91-C3-C	2.5-4	9.0

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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Tank Designation: T-91A, B, and C (cont.)

EPA TEST METHOD 8020 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
T-91-A2-B	1400.0*	1400.0	490.0	2430.0
T-91-A3-B	1900.0*	11,000.0	5800.0	26,700.0*
T-91-A6-B	3.6	9.9	2.9	16.3
T-91-B1-B	4.6	53.0	80.0	460.0
T-91-B2-B	24.0	7.4	12.0	72.0
T-91-B2-C	<2.0	<2.0	<2.0	2.7
T-91-B3-B	6.8	<2.0	4.0	22.0
T-91-C1-C	<1.0	2.4	<1.0	6.2
T-91-C2-B	<2.0	<2.0	<2.0	<2.0
T-91-C3-C	<2.0	<2.0	<2.0	<2.0

Tank Designation: T-91K

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
T-91K1-C	12.5-14	8.4
T-91K2-A	5-6.5	2.6

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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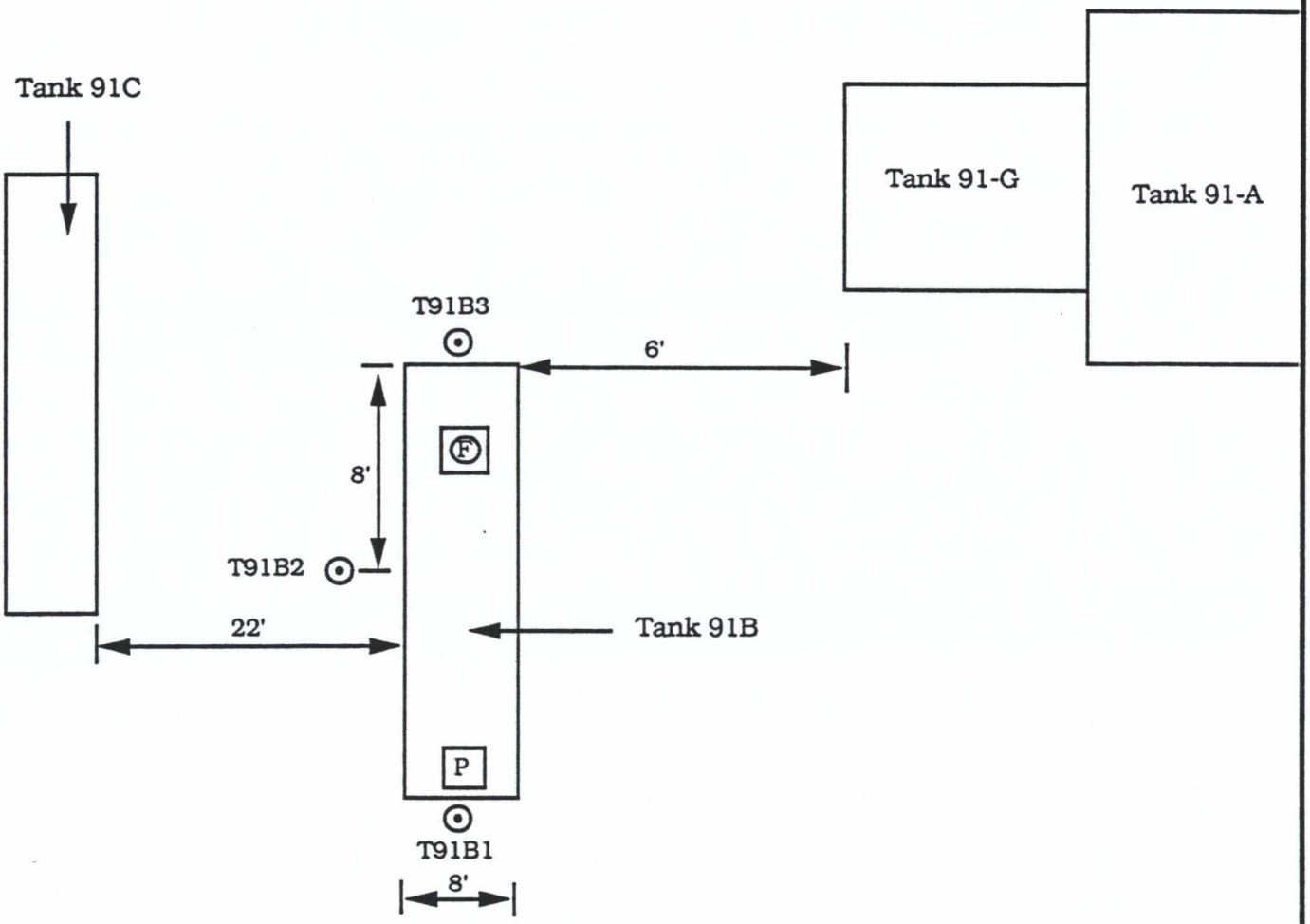
FIGURE 2-3
SITE MAP
TERMINAL 91
TANK 91-B



Legend

- Boring Location
- F Fill Port
- P Pump

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Tank Designation: T-91-D, F, G, N

EPA TEST METHOD 3550/418.1 (mg/kg)

Port of Seattle Sample #	Sample Interval (feet)	TPH[1] Oil & Grease
22-1 T-91-D/F	N/A	22.0
22-2 T-91-D/F	N/A	110.0
22-3 T-91-D/F	N/A	140.0
22-4 T-91-D/F	N/A	79.0
22-5 T-91-D/F	N/A	45.0
23-1 T-91-G	N/A	24.0
23-2 T-91-G	N/A	78.0
23-3 T-91-G	N/A	810.0*
24-1 T-91-N	N/A	50,000.0*

Tank Designation: T-91G

EPA TEST METHOD 8020 (µg/kg)

Port of Seattle Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
23-1 T-91-G	ND	ND	ND	ND
23-2 T-91-G	<10.0	2100.0	630.0	5400.0
23-3 T-91-G	<10.0	5400.0	11,000.0	82,000.0*

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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TERMINAL 91 BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/15/90 Location: Terminal 91
					Ground Surface
					Stiff, moist, gray, fine to medium SANDY SILT, strong odor (ML)
				2	
380			T91A1-A 8:25		
				4	
					- - - - grading wet
				6	
500	418.1	▼	T91A1-B 8:30		GWE @ 6.5 feet Medium dense, wet, gray SILT SAND, strong odor (SM)
				8	Bottom of Hole 7.5 feet.
				10	
				12	
				14	
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/15/90 Location: Terminal 91
					Ground Surface
					Medium dense, damp, brown, fine to medium SILTY SAND, some GRAVELS (SP-SM
				2	Medium dense, moist, gray-brown, fine to medium SAND, trace GRAVELS (SP)
290			T91A2-A 9:36		Stiff, moist, gray, fine to medium SANDY SILT, strong odor (SM)
				4	
				6	
1000+	8015/ 8020	▼	T91A2-B 9:40		GWE @ 6.5 feet Medium dense, moist to wet, gray, fine to medium SAND , strong odor (SP)
				8	Bottom of Hole 7.5 feet.
				10	
				12	
				14	
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
				0
1000+			T91A3-A 11:20	2
				4
1000+	8015/ 8020	▼	T91A3-B 11:25	6
				8
				10
				12
				14
				16
				18
				20
				22
				24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/15/90
Location: Terminal 91

Ground Surface

Concrete 8".

Medium dense, moist, brown, fine to medium SILTY SAND, some GRAVEL, little CLAY, slight odor (SP-SM)

Soft, moist to wet, gray, fine to medium SANDY SILT, strong odor (SM-ML)

Very loose, moist to wet, gray, fine to medium SAND , little SILT, strong odor (SP-SM

GWE @ 6.5 feet

Bottom of Hole 7.5 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring T91A3

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/15/90 Location: Terminal 91
					Ground Surface
					Concrete 8".
					Medium dense, moist, gray, fine to medium SAND, some SILT, strong odor (SP-SM)
				2	
1000+			T91A4-A 11:45		
				4	
					Medium stiff, moist to wet, gray, SILTY CLAY and some fine to medium SAND (ML)
				6	
1000+	418.1	▼	T91A4-B 11:55		GWE @ 6.5 feet
					Loose, wet, gray, fine to medium SAND, trace SILT, strong odor (SP)
				8	
					Bottom of Hole 7.5 feet.
				10	
				12	
				14	
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A4

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/15/90 Location: Terminal 91
					Ground Surface
					Concrete 8".
				2	Medium dense, moist, brown, fine to medium SILTY SAND, little GRAVELS, strong odor (SP-SM)
1000+			T91A5-A 1:10		
				4	Medium stiff, moist to wet, gray, SILT (ML)
		▼		6	GWE @ 6 feet
1000+	8015		T91A5-B 1:15		Medium dense, wet, gray, fine to medium SAND, trace SILT, strong odor (SP)
				8	Bottom of Hole 7.5 feet.
				10	
				12	
				14	
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A5

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/22/90 Location: Terminal 91
					Ground Surface
					Brown to gray moist SILTY SAND/SANDY SILT, strong gasoline odor (SM-ML)
				2	
				4	
		▼		6	GWE @ 6.5 feet
560			T91A6-A 8:45	8	Very loose, wet, gray, medium SAND with pea gravels and shell fragments at 8 feet. Layer of SANDY SILT at 7.5 - 8 feet. Odor of weathered gasoline (SP)
				10	
				12	
100	8015/ 8020		T91A6-B 8:50	14	Soft, wet, gray, fine sandy SILT, faint gasoline odor (ML)
				16	
			T91A6-C 8:55	18	Soft, wet, gray, fine sandy SILT/silty SAND (ML), no odors
				20	Bottom of Hole 19 feet.
				22	GWE = Groundwater encountered
				24	

ERM - Northwest

Boring T91A6

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/22/90 Location: Terminal 91
					Ground Surface
					Asphalt 2"
					Dry, brown, medium SAND, gravelly (SP)
				2	
			T91A7-A 9:21		No recovery
				4	
				6	Moist to wet, gray, gravelly, fine sandy SILT (ML)
			T91A7-B 9:25	8	Soft, moist, gray, fine sandy SILT, some clay, no odors
				10	
					Very loose, wet, gray, silty fine SAND , peat odor (SP-SM)
		▼		12	GWE @ 12.5 feet
			T91A7-C 9:28	14	
					Bottom of Hole 14 feet.
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A7

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/22/90 Location: Terminal 91
					Ground Surface
					Brown silty SAND
				2	
				4	
				6	Gray, moist silty SAND
		▼			GWE @ 7 feet
25			T91A8-A 10:05	8	Loose/medium stiff, gray, wet, interlayered medium SAND and clayey SILT, faint odo weathered gasoline (ML)
				10	
					Loose, wet, gray, silty fine SAND, faint odor of weathered gasoline (SP-SM)
				12	
75	8015		T91A8-B 10:10	14	
				16	
0			T91A8-C 10:15	18	Very loose, wet, silty fine SAND with organics, faint peat odor
					Bottom of Hole 19 feet.
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91A8

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/14/90 Location: Terminal 91
					Ground Surface
					Asphalt 2"
					Medium dense, moist, brown, fine to medium SAND, cobble (Fill) (SP)
				2	
620			T91B1-A 11:00		Loose, moist, gray, fine to medium SAND, gravels and cobbles, strong odor
				4	
				6	
		▼			
500	8015/ 8020		T91B1-B 11:10	8	GWE @ 7.5 feet Stiff, wet, fine SANDY SILT, strong odor (ML)
					Bottom of Hole 9 feet.
				10	
				12	
				14	
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91B1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/14/90 Location: Terminal 91
					Ground Surface
					Asphalt 2"
					Fill Medium dense, moist, brown, fine to medium SAND, some cobble 72" (SP)
85			T91B2-A 12:45	2	
				4	
				6	Medium dense, moist, brown, fine to medium SILTY SAND (SP-SM)
		▼			
100	8015/ 8020		T91B2-B 12:50	8	GWE @ 7.5 feet
				10	grading to medium dense, wet, gray, fine SAND, some SILT (SP-SM)
				12	
	8015/ 8020		T91B2-C 1:00	14	Bottom of Hole 14 feet.
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91B2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
31			T91B3-A 2:40	2–4
75	8015/ 8020	▼	T91B3-B 2:45	8

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/14/90
Location: Terminal 91

Ground Surface

Asphalt 2"

Medium dense, moist, brown, fine to medium SILTY SAND, trace gravels and cobble (SP-SM)

2
4

— — — grading to moist

6

Dense, wet, dark brown, fine to coarse SAND, trace SILT, slight odor (SW)
GWE @ 8 feet

8

Bottom of Hole 9 feet.

10
12
14
16
18
20

GWE = Groundwater encountered

22
24

ERM - Northwest

Boring T91B3

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
				0
14			T91C1-A 9:55	2
				4
				6
22		▼	T91C1-B 10:05	8
27				10
				12
11	8015/ 8020		T91C1-C 10:10	14
				16
				18
				20
				22
				24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/14/90
Location: Terminal 91

Ground Surface

Asphalt 2"

Loose, brown, moist, fine to medium SILTY SAND, some gravels, no odor (SP-SM)

- - - - grading to more gravels/cobbles

GWE @ 8 feet

Dense, wet, gray-brown fine SAND, trace SILT, no odor (SP)

Stiff, wet, gray SILT, no odor (ML)

Bottom of Hole 14 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring T91C1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/14/90 Location: Terminal 91
					Ground Surface
					Asphalt 2"
					Dense, moist, brown, fine to medium SAND, some gravel (SP)
			T91C2-A 1:25	2	
				4	
				6	
		▼			Medium dense, wet, dark brown, fine to coarse SAND, trace GRAVEL and SILT, slight odor (SW) GWE @ 7.5 feet
50	8015/ 8020		T91C2-B 2:00	8	
					Bottom of Hole 9 feet.
				10	
				12	
				14	
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91C2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
12			T91C3-A 3:15	2–4
14	8015/ 8020	▼	T91C3-B 3:20 T91C3-C 3:25	6–8

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/14/90
Location: Terminal 91

Ground Surface

Asphalt 2"

Dense, moist, brown, fine to medium SILTY SAND, some gravels and cobble (SP-SM

2

4

6

— — — grading wet

GWE @ 7.5 feet

8

Medium dense, wet, dark brown-gray, fine to coarse SAND, trace CLAY (SW)

Bottom of Hole 9 feet.

10

12

14

16

18

20

GWE = Groundwater encountered

22

24

ERM - Northwest

Boring T91C3

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/26/90 Location: Terminal 91
					Ground Surface
					Asphalt 2"
					Loose, damp, brown, fine to coarse silty SAND with cobbles/gravels, no odor (SW-SM
0			T91K1-A 3:00	2	
				4	
				6	grading less gravels and cobbles
					Medium dense to loose, wet, gray-brown, silty SAND, shell fragments, no odor (SP-S
			T91K1-B 3:05	8	
		▼		10	GWE @ 10 feet
				12	
	8015		T91K1-C 3:10		no odor
				14	Bottom of Hole 14 feet.
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91K1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/22/90 Location: Terminal 91
					Ground Surface
					Asphalt
					Dry to damp, brown, fine sandy SILT, some gravels (ML)
				2	
				4	
	8015		T91K2-A 3:30	6	
					Medium stiff, wet, brown (trace gray) fine sandy SILT, trace clay and small gravels
		▼	T91K2-B 3:35	8	GWE @ 8 feet
				10	
					Very loose, wet, gray, SAND, shell fragments (SP)
				12	
			T91K2-C 3:40		
				14	
					Bottom of Hole 14 feet.
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring T91K2

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 3

Fisherman's Terminal

Site Location

Fisherman's Terminal is generally located north of West Emerson Place, south of Salmon Bay, east of 21st Street West and east of 15th Avenue West. The site location is shown on the Vicinity Map, Figure 3-1.

Site Procedures

Tank assessment procedures for two 500 gallon waste oil tanks located at Fisherman's Terminal facility were performed on June 18, 1990. The assessment program consisted of drilling a total of four soil borings and collecting soil samples at selected intervals. The tank designations are G and H.

Tank G is situated along the southeastern portion of the property. The borings advanced adjacent to Tank G ranged in total depths from 6 feet (FTG2) to 11.5 feet (FTG1) below ground surface.

Tank H is situated along the northwestern portion of the property. The borings advanced adjacent to Tank H ranged from 7 feet (FTH2) to 12 feet (FTH1) below ground surface.

The approximate location of the soil borings are depicted on the Site Plans, Figure 3-2 (Tank G) and Figure 3-3 (Tank H).

The OVA was not utilized to detect possible VOC levels for soil samples collected at Fisherman's Terminal. In order to compensate and assure proper laboratory assignment, TLC analyses were conducted for all soil samples obtained. The TLC test results are summarized in the analytical laboratory section presented below.

Site Conditions

The boring logs presented at the conclusion of this section indicate that the asphalt at the two tank areas is underlain by a two foot thick layer of fill soil. The fill encountered is described as dry to damp, black to brown, silty sand with some cobble and gravel.

The soil beneath the fill in the area of Tank G is described as firm to medium stiff, moist to wet, brown to gray, clayey silt (FTG1) and soft, moist to wet, gray, silty clay (FTG2). The soil beneath the fill in the area of Tank H is described as firm, gray, silty clay and clayey silt,

underlain by a two foot thick layer of medium dense, moist, mottled gray, fine sand (FTH1) and firm to stiff, moist, silty clay with interbedded fine to medium sand (FTH2).

No visual indications of contamination from the soil samples collected at either tank location were observed. However, during drilling of boring FTG1, free oil was observed on the outside of the auger flight as it was pulled from the boring. A grab sample of the oil and soil mixture was collected. This sample is identified as FTG-1E. This sample probably represents an area of the tank backfill located at a depth of 4 to 7 feet below the ground surface.

Ground water was encountered in all of the subsurface borings excavated at Fisherman's Terminal. Ground water was present at depths ranging from 3 to 3.5 feet below ground surface in soil borings FTG1 and FTG2. Ground water was present in soil borings FTH1 and FTH2 at a depth of 5 feet below ground surface.

Analytical Results

Eleven samples were collected from the four soil borings excavated at Fisherman's Terminal. One soil sample from each soil boring was analyzed for TPH. Based on visual observations, soil sample FTG1-E was analyzed for possible VOC and PCB content. The analytical laboratory results for each tank area are described below and summarized in Table 3-1 of this section.

Tank G

TLC analyses were performed for all of the soil samples collected at the Tank G location. The analyses performed indicates positive results for soil samples FTG1-A, FTG2-1, and FTG1-E.

Soil samples FTG1-A (4 feet below surface) and FTG2-A (6 feet below surface) yielded levels of TPH above proposed MTCA limits. FTG1-A and FTG2-A exhibited TPH concentrations of 410 mg/kg and 2000 mg/kg, respectively.

Soil sample FTG-1E was observed to contain free oil. Based on the visual appearance of the sample, FTG1-E was analyzed for possible VOC and PCB content. The result of the VOC analysis indicates a total xylene concentration of 74 µg/kg. No PCBs were present in concentrations above the laboratory method detection limits.

Tank H

TLC analyses were performed for all of the soil samples collected at the Tank H location. The analyses performed indicated positive indications of TPH content for FTH1-A and FTH2-B.

Soil samples FTH1-A (4 feet below surface) and FTH2-B (6.5 feet below surface) yielded respective TPH concentrations of 120 mg/kg and 190 mg/kg. Although these TPH levels are within the allowable limits for soil cleanup under the proposed MTCA limits, the levels are close to the MTCA limit of 200 mg/kg for TPH in soils.

Conclusion

The TPH and the TLC test results of FTG1-A (4 feet below surface) and FTG2-A (7 feet below surface) suggest that soil contamination has resulted from a release of product from Tank G. The total vertical extent of contamination is likely to be at least four feet in thickness. The above interval indicates that ground water in this tank area may also be adversely impacted. However, the laboratory analyses conducted for sample FTG1-E does not indicate the presence of VOC and PCB constituents.

The analytical laboratory and TLC results of FTH1-A, FTH2-A and FTH2-B suggest the presence of TPH from a depth of 2.5 feet to 6.5 feet below ground surface. The test results for samples FTH1-A and FTH2-B indicate concentrations marginally below proposed action limits. Further TLC testing performed on samples collected at depths of 7.5 feet and 11.5 feet did not indicate the presence of TPH waste oil.

Summary of POS Tank Assessment

POS personnel conducted a soil excavation and sampling program in May of 1990 to assess subsurface conditions adjacent to Tank L situated south of a loading dock that extends east of Building C-2 at Fisherman's Terminal. Information obtained indicates that Tank L has a capacity of 3,000 gallons and contains heating oil. The summary of the excavation, sampling and analytical results are presented below.

Summary of POS Field Notes

POS personnel utilized a backhoe to excavate soils along the sides of Tank L to a depth of 8 feet below ground surface. The materials encountered are described as being gray in color and possessing an oily odor. Loose, fluid sludge was also encountered during excavation operations as well as oily water which was noted to emanate from beneath the tank.

The notes indicate that FT-Lse and FT-Lnw were collected along the northwest and southeast portions of the excavation at respective depths of 6 and 8 feet below ground surface. This material above is surmised to be consistent with the material collected in samples FT-Lse and FT-Lnw.

POS Analytical Results

TPH (oil and grease) analyses were performed on samples FT-Lse and FT-Lnw in accordance with EPA Test Methods 3550 and 418.1. The results indicated that samples FT-Lse and FT-Lnw possessed concentrations of 660 and 470 mg/kg, respectively. These levels exceed the proposed MTCA limits for TPH (oil and grease) concentrations in soils of 200 mg/kg.

BTEX analyses were also performed for both of the above samples. The results of the analyses indicated levels in the parts per billion range and significantly below proposed MTCA limits.

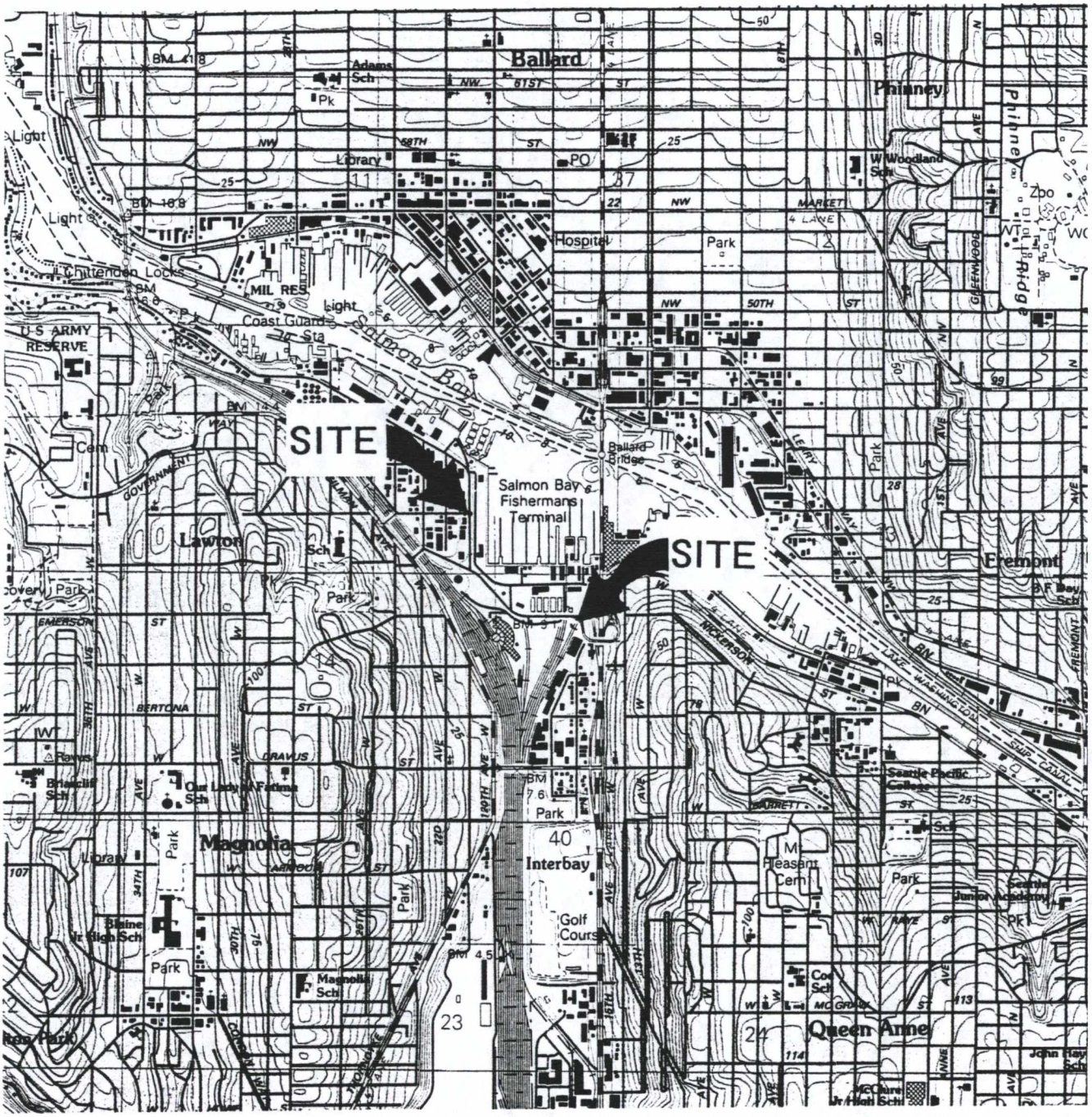
Conclusion

The analytical laboratory results and information obtained from the POS field notes suggest that TPH contamination may exist from 2 to 8 feet below ground surface from a release of Tank L. Based on the description of fluids noted at the base of the tank excavation and the vertical extent of contamination at Tank L, ground water may be adversely impacted.

FIGURE 3-1

VICINITY MAP

FISHERMANS' TERMINAL



Source: 1983 USGS
Seattle North Quadrangle

State of Washington

Scale 1:25 000

N

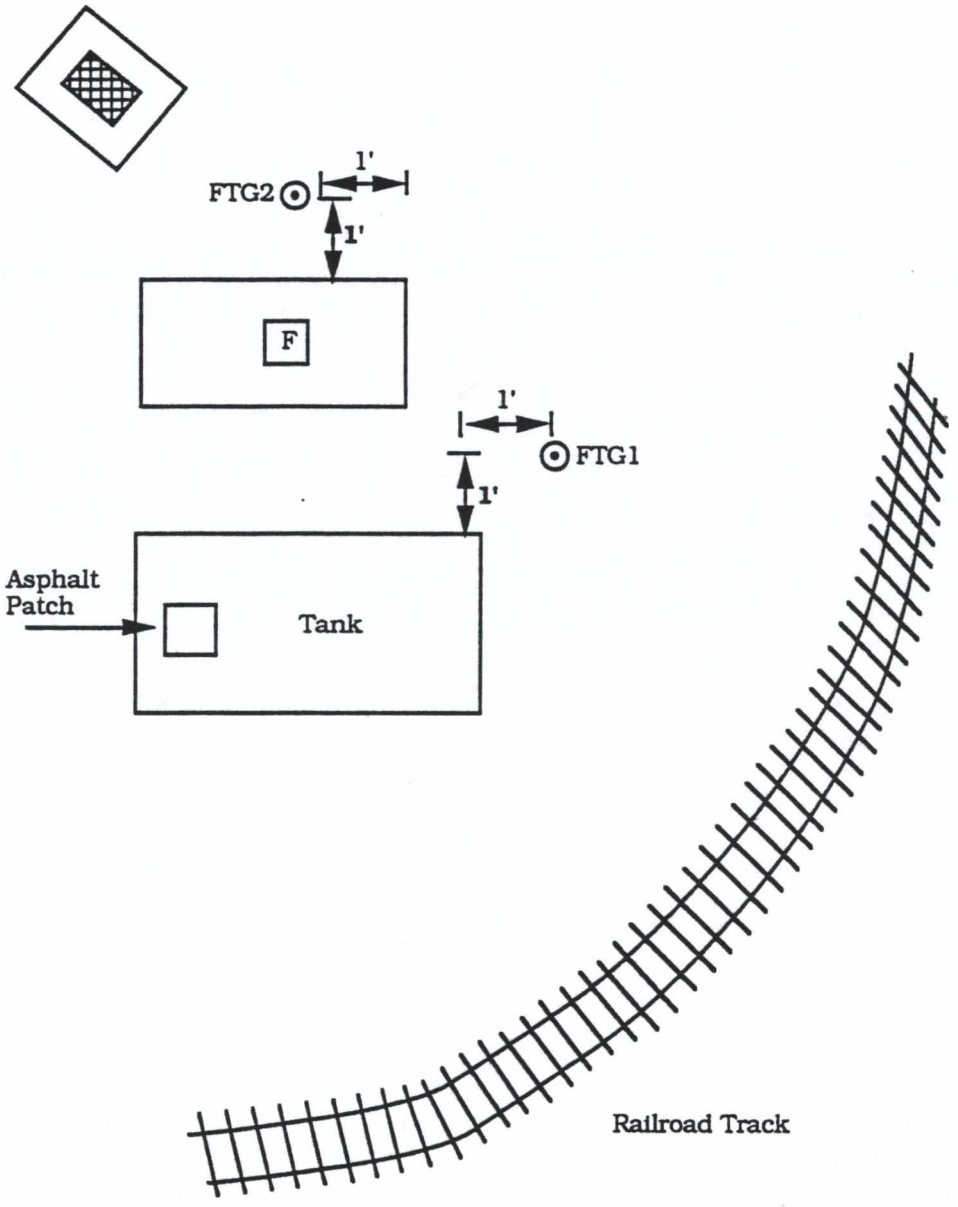
PROJECT# 64001.00

ERM

FIGURE 3-2

SITE MAP

FISHERMAN'S TERMINAL
TANK G



Legend

F-Funnel

⊙ Boring Location

N

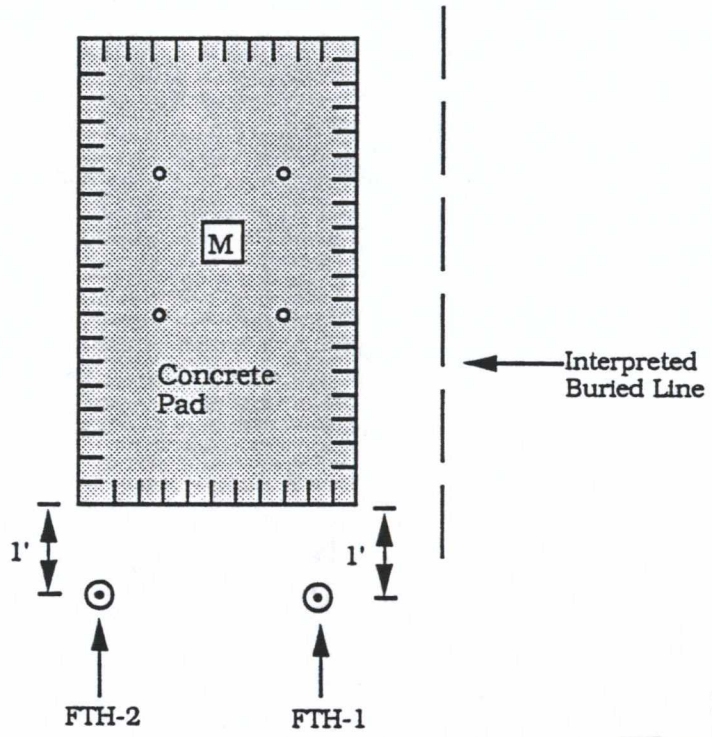
NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 3-3
SITE MAP

FISHERMAN'S TERMINAL
TANK H



Legend

- M — Waste Oil Tank Manway
- o — Bumper Guard
- ⊙ — Boring Location

N

NOT TO SCALE

PROJECT# 64001.00

ERM

TABLE 3-1
Analytical Results for Fisherman's Terminal

Tank Designation: G

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
FTG1-A	2.5-4	410.0*
FTG2-A	4.5-6	2000.0*

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Sample Interval (feet)	Acetone	Methylene Chloride	Ethyl-benzene	Total Xylene
FTG1-E	4-6	ND	ND	ND	74.0

EPA TEST METHOD 8080 (mg/kg)

ERM-NW Sample #	PCBs
FTG1-E	ND

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

The ERM Group

Tank Designation: H

EPA TEST METHOD 418.1 (mg/kg)

ERM Sample #	Sample Interval (feet)	TPH[1]
FTH1-A	2.5-4	120.0
FTH2-B	5-6.5	190.0

Tank Designation: L

EPA TEST METHOD 3550/418.1

Port of Seattle Sample #	Sample Interval (feet)	TPH[1] Oil & Gas
FT-Lse	N/A	660.0*
FT-Lnw	N/A	470.0*

EPA TEST METHOD 8020 (µg/kg)

Port of Seattle Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
FT-Lse	ND	220.0	ND	300.0
FT-Lnw	ND	310.0	860.0	2800.0

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

The ERM Group

FISHERMAN'S TERMINAL BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
	418.1	▼	FTG1-A 9:35	2
				4
			FTG1-B 9:45	6
			FTG1-C 2:55	8
			FTG1-D 3:02	10
				12
				14
				16
				18
				20
				22
				24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/18/90
Location: Fishermens' Terminal

Ground Surface

Asphalt 2"
Dry to damp, black, fine to medium SILTY SAND, small cobble/gravels (SP-SM)
- - - - cobble

Firm, moist, dark brown, CLAYEY SILT, some gravels (ML)

GWE @ 3.5 feet

- - - - wood

No recovery. Obtained grab from auger flight 9:45.

Medium stiff, wet, gray

Bottom of Hole 11.5 feet.

*Oil on auger @ 3 feet below ground surface.
FTG1-E - Grab sample of oil coated silt and fine gravel cuttings
Time: 3:08. Analysis performed: 8240/8080

GWE = Groundwater encountered

ERM - Northwest

Boring FTG1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
	418.1	▼	FTG2-A 10:00	0 2 4 6 8 10 12 14 16 18 20 22 24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/18/90
Location: Fishermens' Terminal

Ground Surface

Asphalt 2"

Loose, moist, dark brown, fine to medium SILTY SAND, trace clay (SM)

– – – – grading moist to wet

Soft, moist to wet, gray SILTY CLAY (CL)
GWE @ 3 feet

Bottom of Hole 6 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring FTG2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/18/90 Location: Fishermens' Terminal
					Ground Surface
					Asphalt 2"
					Medium moist, brown, fine to medium SILTY SAND, little clay(SM)
				2	
					Firm, moist, gray, silty fine CLAY, little fine to medium SAND (CL)
	418.1		FTH1-A 11:30		
		▼		4	
					- - - - becoming moist, stiff CLAY with fine sand
					GWE @ 5 feet
			FTH1-B 11:35	6	
				8	
				10	
			FTH1-C 1:46		Medium dense, moist, mottled gray fine SAND, no odor
				12	
					Bottom of Hole 12 feet.
				14	
				16	
				18	
				20	
				22	
				24	
					GWE = Groundwater encountered

ERM - Northwest

Boring FTH1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/18/90 Location: Fishermens' Terminal
				0	Ground Surface
					Asphalt 2" Medium moist, brown, fine to medium SILTY SAND, little clay(SM)
				2	Firm, moist, gray, silty fine CLAY, little fine to medium SAND (CL)
		▼	FTH2-A 11:45	4	– – – – becoming moist, stiff CLAY with fine sand GWE @ 5 feet
	418.1		FTH2-B 12:00	6	No recovery. Grab from auger flight.
					Bottom of Hole 7 feet.
				8	
				10	*STP @ 5-6.5 feet.
				12	
				14	
				16	
				18	
				20	
				22	
				24	GWE = Groundwater encountered

ERM - Northwest

Boring FTH2

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 4

Shilshole Bay Marina

Site Location

Shilshole Bay Marina is located near the north end of Seaview Avenue in Ballard. The approximate site location is shown on Figure 4-1.

Site Procedures

Tank assessment procedures at Shilshole Bay Marina were initiated on June 19, 1990. Seven underground storage tanks were assessed at this location. These seven tanks included five 500 gallon waste oil tanks (POS tank designations are M-1, M-2, M-3, M-4, and M-5), one 550-gallon gasoline tank (POS tank designation M-7), and Tank n, a 10,000 diesel tank. These tanks are located along the western portion of the site.

Two borings were drilled at each of Tanks M-1, M-2 and M-7 (see Site Maps, Figures 4-2, 4-3 and 4-7). One boring was drilled at each of Tanks M-3, M-4 and M-5 (see Site Maps, Figures 4-4, 4-5 and 4-6). Four borings were drilled adjacent to the Tank Farm Area (see Site Maps, Figure 4-8). The depth of the borings range from 14 to 24 feet below ground surface. The boring logs attached at the end of this report section depict the tank areas and boring locations.

Site Conditions

As indicated on the attached boring logs, the soils encountered at Shilshole Bay Marina consist generally of medium-dense, well-graded sand with occasional interbedded silts and sandy silts. Ground water was encountered at 8 to 10 feet below ground surface.

OVA readings were recorded from nearly every boring, and the readings range from zero to greater than 1,000 ppm. The highest OVA readings were recorded in the area of Tank n (Boring SBMn-2).

Analytical Results-Waste Oil Tanks

In general, two soil samples were submitted for laboratory analyses from each tank location. One sample was analyzed only for TPH, whereas the second sample was analyzed for TPH, volatile organics,

and PCBs. Refer to Table 4-1 for a complete summary of the analytical results.

Tank M-1

TLC analysis performed on the Tank M-1 samples yielded positive results for samples M-1-1A and M-1-2A. Both of these samples were collected 4 feet below ground surface. TLC results were negative for samples 1B, 1C, 2B and 2C.

The analytical results for sample M-1-2A yielded a TPH value of 390 mg/kg. This is above the proposed MTCA limit of 200 mg/kg for TPH as waste oil in soils. In addition, some levels of acetone were also detected in the volatile organic scan. However, the presence of acetone may be a false positive. A note attached to the analytical report indicates that acetone is a solvent used in the extraction procedure for the volatile organics. The presence of acetone is probably due to laboratory contamination and is not a true representation of soil conditions.

The TPH result for sample M-1-1A was 82 mg/kg, which is below the proposed MTCA limit.

Tank M-2

TLC performed on samples collected from Tank M-2 yielded positive results for samples M-2-1A and M-2-2A. TLC results were negative for samples 1B, 1C, 2B and 2C.

The analytical results for sample M-2-1A (4 feet below ground surface) yielded a TPH level of 3700 mg/kg, well above the proposed MTCA limit of 200 mg/kg for soil cleanup. This sample was also analyzed for volatile organics, with the result that some acetone was detected in the sample. Low levels (below proposed MTCA limits) of toluene, ethylbenzene and xylene were also detected. Sample M-2-1B yielded a TPH concentration of 1.6 mg/kg.

The analytical results for sample M-2-2A (4 feet below surface) indicate an elevated TPH level of 2700 mg/kg, and some volatile organics were detected at low levels. The volatile organics detected in this sample are within the proposed MTCA soil cleanup limits. Sample M-2-2B (8.5 feet below surface) yielded 95 mg/kg TPH, also below the proposed MTCA limit.

Tank M-3

At Tank M-3, TLC analysis yielded positive results for samples M-3-1A and M-3-1B. The analytical laboratory results for sample M-3-1A (4 feet below surface) indicate a TPH value of 280 mg/kg, in excess of the

proposed MTCA limit for TPH as waste oil in soils. The analytical results for sample M-3-1B yielded 16 mg/kg TPH, well below the proposed MTCA cleanup limit of 200 mg/kg of TPH as waste oil in soils.

Tank M-4

TLC analysis yielded negative results for samples M-4-1B and M-4-1C. The analytical laboratory results for sample M-4-1B (8.5 feet below surface) yielded values well below the proposed MTCA cleanup limit, see Table 4-1. Sample M-4-1C was not submitted for laboratory analysis.

Tank M-5

At Tank location M-5, TLC analyses yielded negative results for samples M-5-1B and M-5-1C. The analytical laboratory results for sample M-5-1B (8.5 feet below surface) yielded a TPH value well below the proposed MTCA cleanup limit for soil. Sample M-5-1C was not submitted for laboratory analysis.

Fuel Tanks

Tank M-7

TLC analysis for Tank M-7 yielded positive results for samples M-7-1B and M-7-2A. However, the analytical laboratory results for M-7-1B and M-7-2A were below proposed MTCA limits for TPH.

Tank n

TLC analysis performed on samples collected from soil borings for Tank n yielded positive results for sample SBMn-2A only.

The samples from Tank n were analyzed for TEPH. All the analytical results were below the proposed MTCA cleanup limits. However, soil conditions during drilling suggested that there may be free product atop the ground water. Additionally, there was a wide range of OVA readings associated with borings SBMn-1 and SBMn-2. A reading as high as 1,000 ppm was detected at 12.5 to 14 feet below the ground water table (approximately 9 feet) in boring SBMn-2. The field observations, including the OVA readings, indicate significant contamination near Tank n, although the analytical data does not substantiate the field observations (see the Boring Logs attached at the end of this report section).

An additional boring, SH-4, was drilled west of Tank SBMh and along the northwest end of the Tank Farm Area (see Site Map, Figure 4-8).

The TLC analysis performed on sample SH-4-1C yielded positive results. The analytical laboratory results for tank sample SH-4-1C (14 feet below ground surface) yielded a TPH value of 1100 mg/kg, well above the 200 mg/kg proposed MTCA limit for TPH as diesel and the 100 mg/kg limit for TPH as gasoline.

Conclusions

The analytical results indicate a high potential for releases of product having occurred from Tanks M-1, M-2 and M-3 and/or their associated piping systems. Contamination at these tank locations occurs to a depth of at least four feet but may be as deep as six or seven feet.

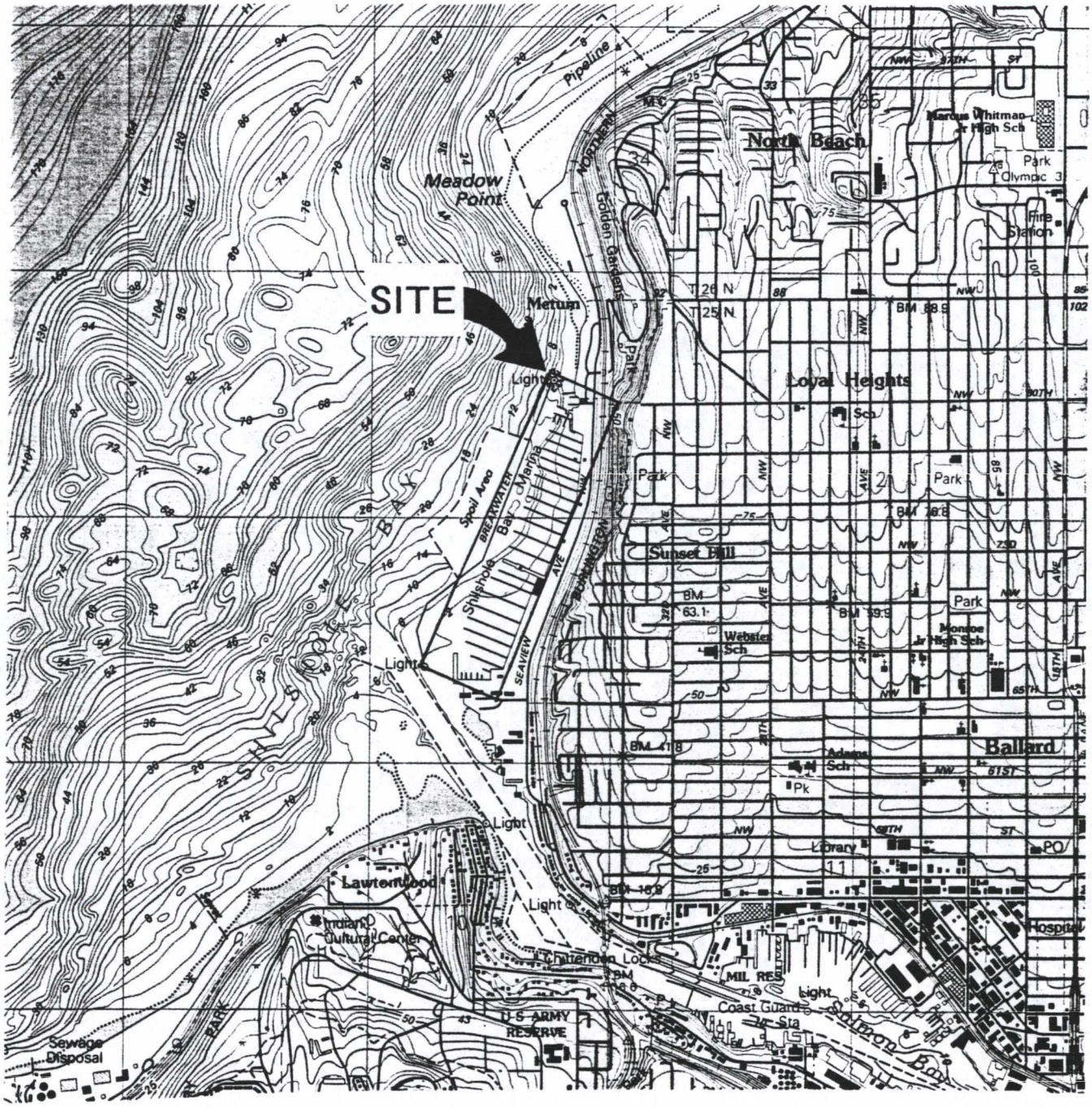
Field monitoring and observations suggest that the potential for releases having occurred from Tank n is probably high, although the analytical data does not back up the observations.

Analytical results indicate that a release of product has occurred in the vicinity of Tank SBMh, as indicated in Boring SH-4. The contamination may extend as deep as 14 feet below ground surface.

FIGURE 4-1

VICINITY MAP

SHILSHOLE BAY MARINA



Source: 1983 USGS
Seattle North Quadrangle

State of Washington

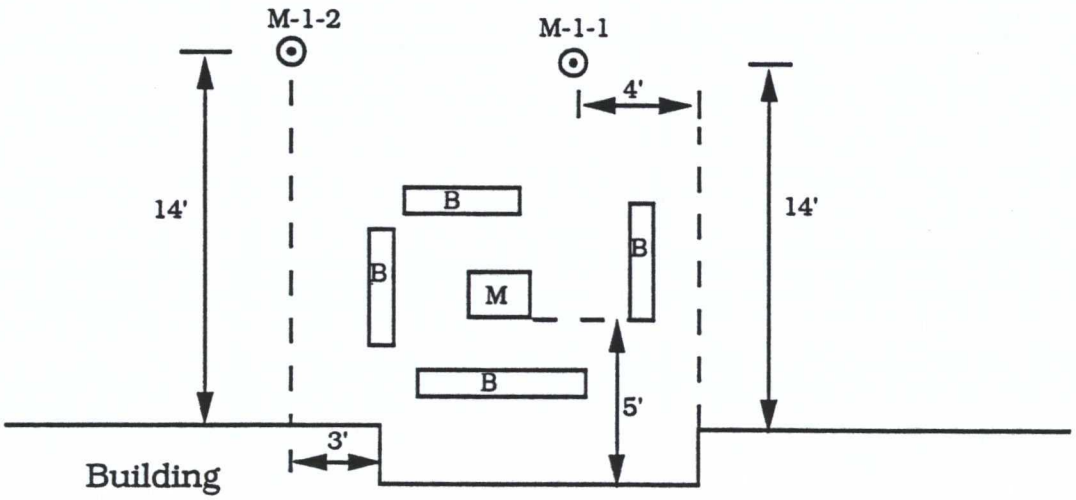
Scale 1:25 000

N

PROJECT# 64001.00

ERM

FIGURE 4-2
BORING LOCATIONS
SHILSHOLE BAY MARINA
TANK M-1



Legend

F Fill Cap
o Bumper Guard
⊙ Boring Locaiton
B Concrete Parking Curb
M Waste Oil Tank Manway

N

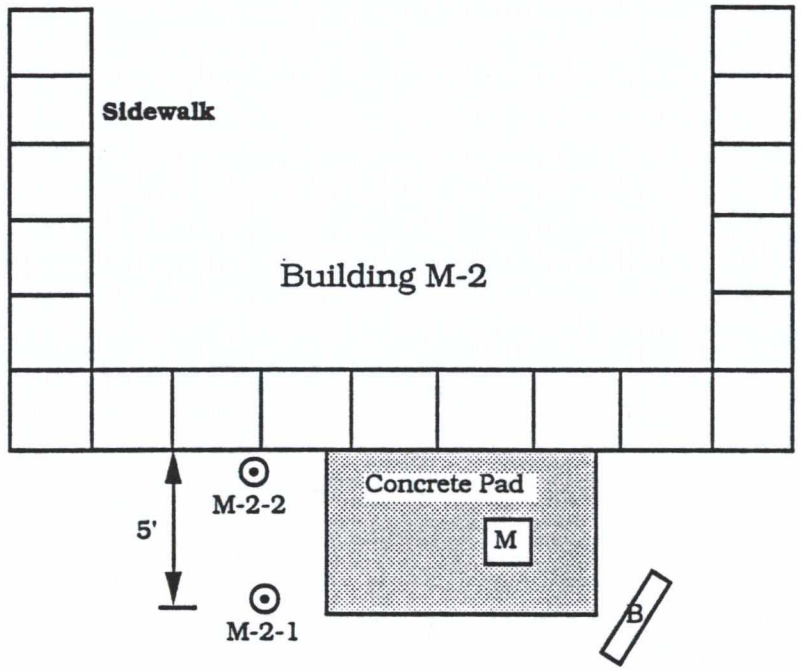
NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-3
BORING LOCATIONS

SHILSHOLE BAY MARINA
TANK M-2



Note: 2-1 and 2-2 are located one foot West of the concrete pad.

Legend

- ⊙ Boring location
- B Concrete Parking Curb
- M Waste Oil Tank Manway

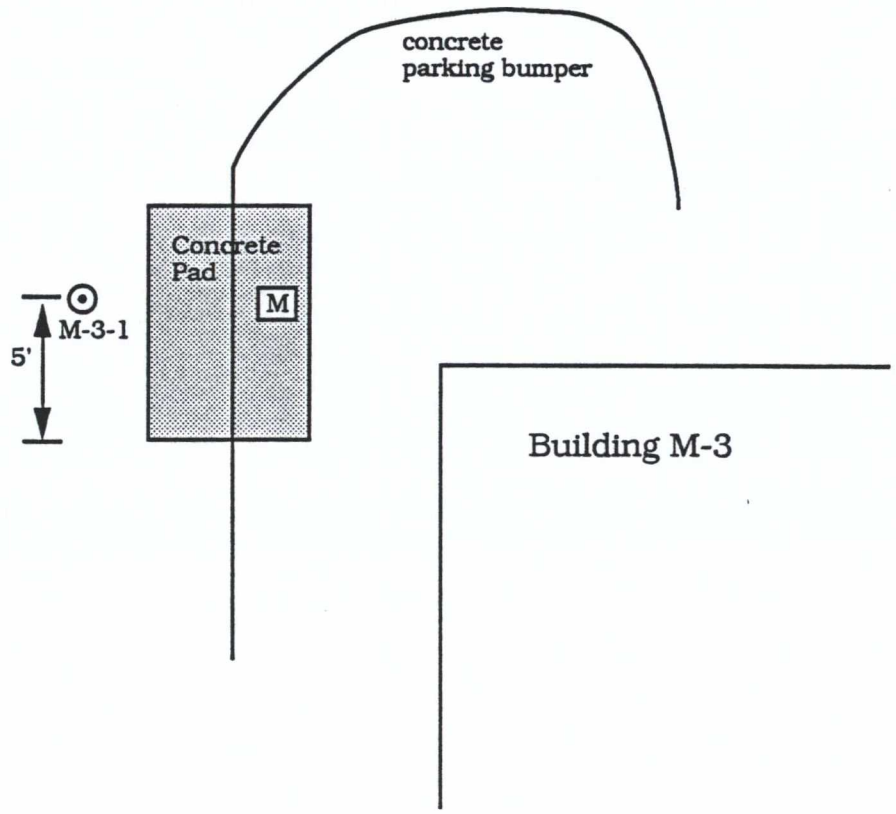
N

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-4
BORING LOCATIONS
SHILSHOLE BAY MARINA
TANK M-3



Note: M-3-1 is located one foot West of the concrete pad

Legend

[M] Waste Oil Tank Manway

⊙ Boring Location

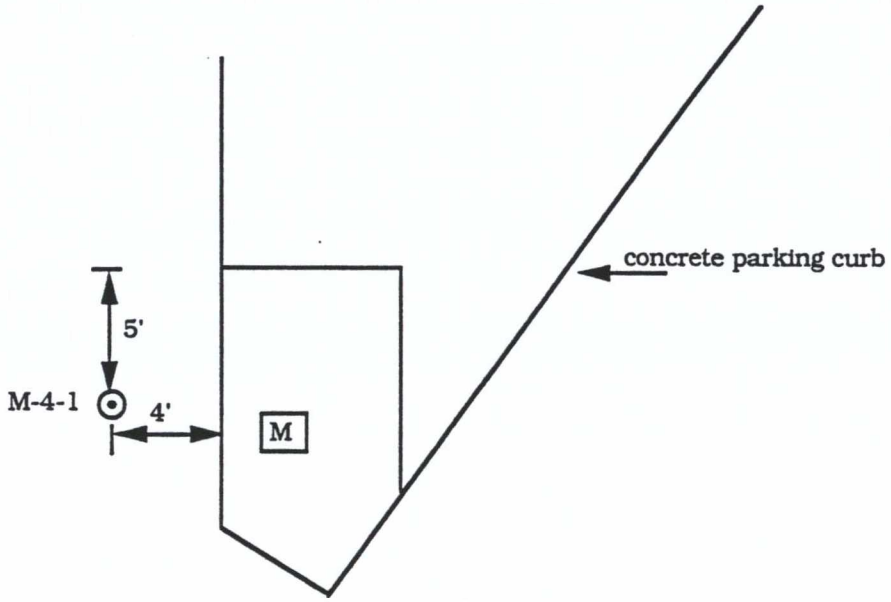
N

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-5
BORING LOCATIONS
SHILSHOLE BAY MARINA
TANK M-4



Legend

M - Waste Oil Tank Manway

⊙ Boring Location

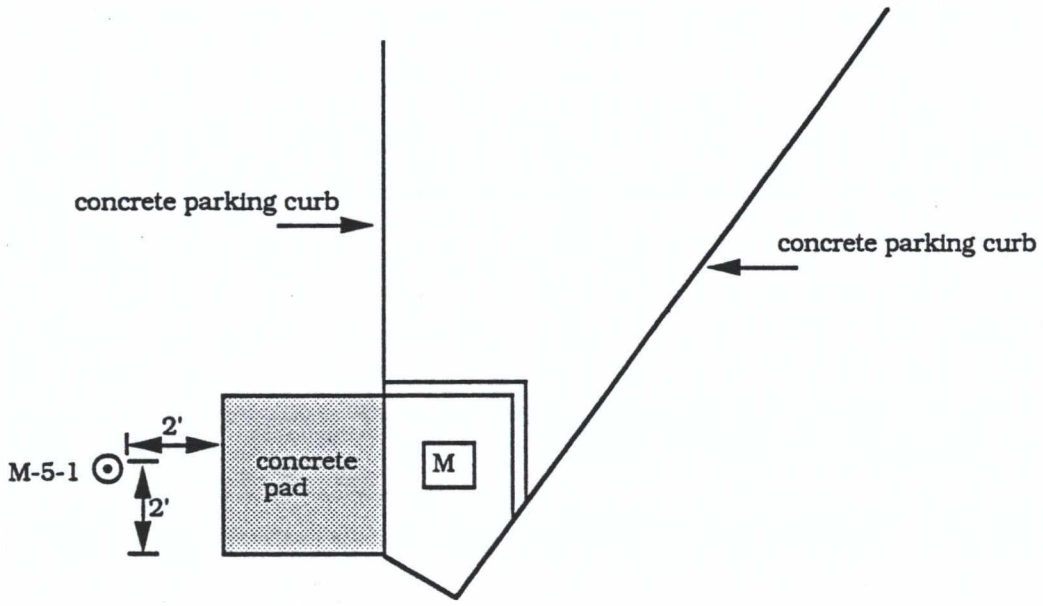
N

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-6
BORING LOCATIONS
SHILSHOLE BAY MARINA
TANK M-5



Legend

⊙ Boring Location

M Waste Oil Tank Manway

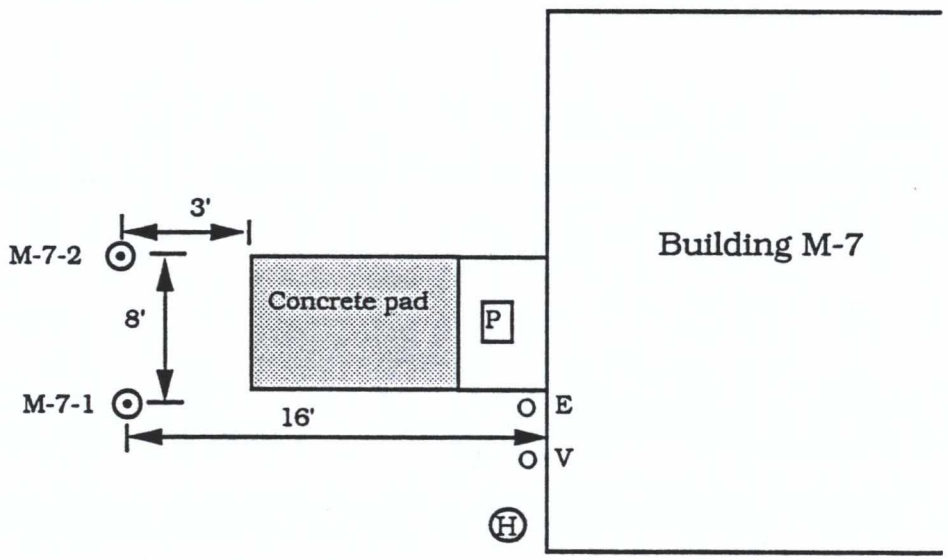
N

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-7
BORING LOCATIONS
SHILSHOLE BAY MARINA
TANK M-7



Legend

- ⊙ Boring Location
- O E Electric Line
- O V Vent Pipe
- P Gas Pump
- Ⓗ Hydrant

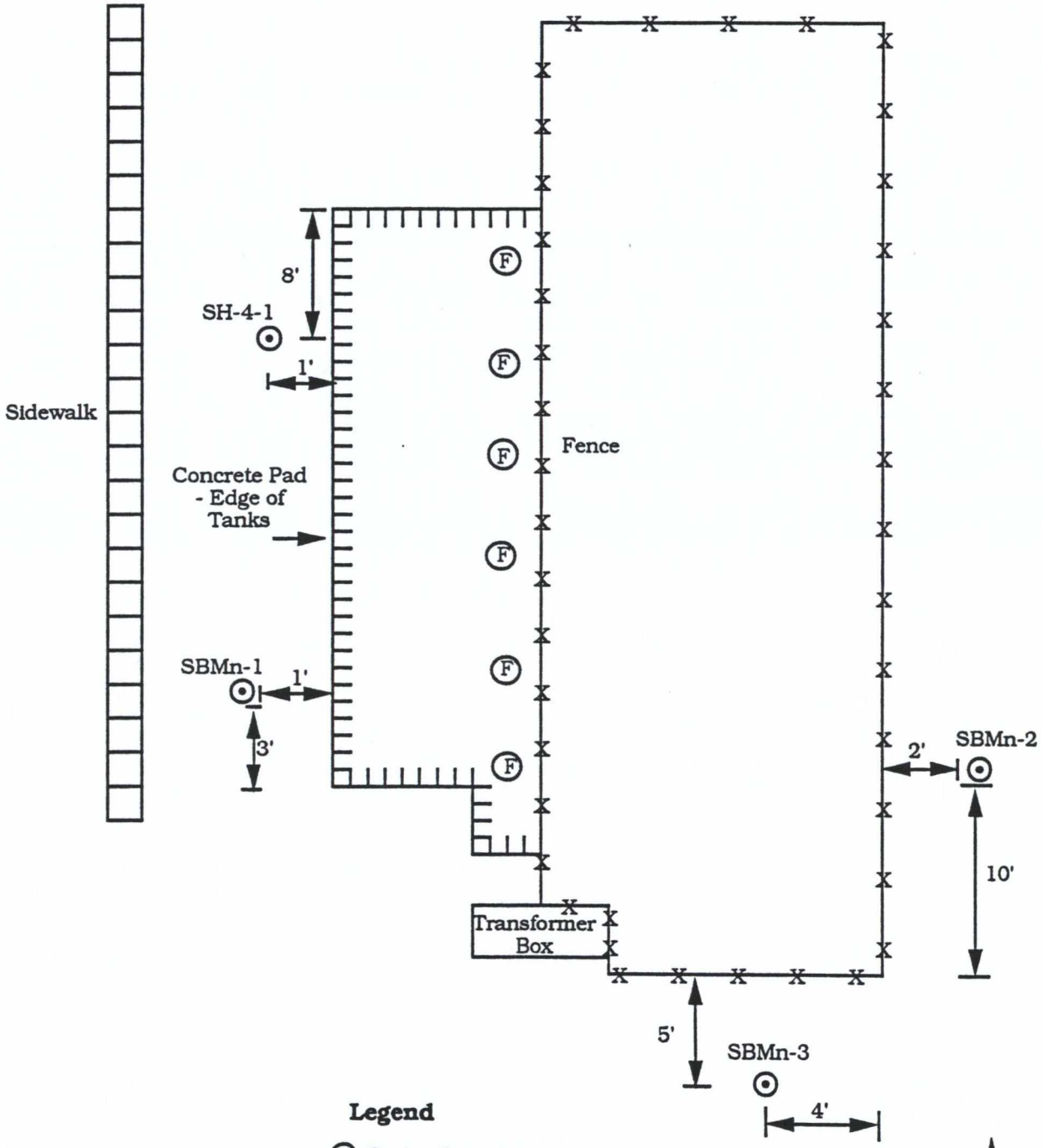
N

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 4-8
BORING LOCATIONS
SHILSHOLE BAY MARINA
SBM TANK n



NOT TO SCALE

PROJECT# 64001.00

ERM

TABLE 4-1
Analytical Results for Shilshole Bay Marina

Tank Designation: M-1

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-1-1A	2.5-4	82.0
M-1-2A	2.5-4	390.0*
M-1-2B	7.5-9	<0.5

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Acetone	Benzene	Toluene	Ethyl-benzene	Total Xylene
M-1-2A	23.0	ND	ND	ND	ND

EPA TEST METHOD 8080 (µg/kg)

ERM-NW Sample #	PCBs
M-1-2A	ND

[1] TPH - Total Petroleum Hydrocarbons
[2] TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

The ERM Group

Tank Designation: M-2

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-2-1A	2.5-4	3700.0*
M-2-1B	7.5-9	1.6
M-2-2A	2.5-4	2700.0*
M-2-2B	7.5-9	95.0

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Acetone	Benzene	Toluene	Ethyl-benzene	Total Xylene
M-2-1A	63.0	ND	14.0	54.0	260.0
M-2-2A	110.0	ND	16.0	59.0	172.0

EPA TEST METHOD 8080 (µg/kg)

ERM-NW Sample #	PCBs
M-2-1A	ND
M-2-2A	ND

[1] TPH - Total Petroleum Hydrocarbons
[2] TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

Tank Designation: M-3

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-3-1A	2.5-4	280.0*
M-3-1B	7.5-9	16.0

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Acetone	Benzene	Toluene	Ethyl-benzene	Total Xylene
M-3-1A	29.0	ND	ND	ND	ND

EPA TEST METHOD 8080 (µg/kg)

ERM-NW Sample #	PCBs
M-3-1A	ND

Tank Designation: M-4

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-4-1B	7.5-9	3.4

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

The ERM Group

Tank Designation: M-5

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-5-1B	7.5-9	1.3

Tank Designation: M-7

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
M-7-1B	7.5-9	<0.5
M-7-2A	2.5-4	79.0

Tank Designation: SH-4

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
SH-4-1C	12.5-14	1100.0*

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Acetone	Benzene	Toluene	Ethyl-benzene	Total Xylene
SH-4-1C	39.0	ND	ND	ND	ND

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

The ERM Group

Tank Designation: SBMn

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]	TPH[1] (duplicate analysis)
SBMn-1B	7.5-9	5.5	6.1
SBMn-2B	7.5-9	22.0	15.0
SBMn-2C	12.5-14	9.5	16.0
SBMn-3D	17.5-19	9.8	

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
SBMn-2C	ND	ND	ND	ND

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

SHILSHOLE BAY MARINA BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/19/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium dense, gray, moist, fine to medium SAND, trace small gravels, shell fragments (SP)
	418.1		M-1-1A 3:05	2–4	
				6	— — — Becoming very moist
		▼	M-1-1B 3:10	8	GWE @ 8.5 feet
				10	
			M-1-1C 3:15	12–14	
				14	Bottom of Hole 14 feet.
				16–24	
					GWE = Groundwater encountered

ERM - Northwest

Boring M-1-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
	418.1 8240 8080		M-1-2A 3:30	2 4
		▼		6
	418.1		M-1-2B 3:35	8
				10
			M-1-2C 3:40	12 14
				16 18 20 22 24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/19/90
Location: Shilshole Bay Marina

Ground Surface

Asphalt 2"

Dense, moist, gray to light brown, fine to coarse sand, small gravels and shell fragments (SW)

GWE @ 7.5 feet

— — — saturated

Bottom of Hole 14 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring M-1-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/19/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium, moist, light brown, fine SAND (SP)
				2	Medium stiff, moist, dark brown to black fine to medium sandy CLAY (SC). Odor
75	418.1 8240 8080		M-2-1A 11:13	4	
					— — — grading less sand
				6	
					Medium dense, moist, gray brown, fine SAND (SP)
25	418.1	▼	M-2-1B 11:20	8	GWE @ 9 feet
				10	— — — grading wet, black, sand
				12	Medium dense, wet, black, SAND (SP)
28			M-2-1C 11:30	14	Bottom of Hole 14 feet.
				16	
				18	GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-2-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/19/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Moist, brown, fine SAND (SP)
				2	
85	418.1 8240 8080		M-2-2A 12:15		Medium stiff, moist, black, sandy CLAY, (with brown sand) (SC)
				4	
				6	
				8	
60	418.1	▼	M-2-2B 12:20		Medium dense, moist to wet, dark gray to black SAND (SP) GWE @ 9 feet
				10	— — — saturated
				12	
25			M-2-2C 12:25		
				14	Bottom of Hole 14 feet.
				16	
				18	GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-2-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/20/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium dense, damp, brown, fine to coarse sand, some cobbles and gravels (SW)
				2	
24	418.1 8240 8080		M-3-1A 1:40		grab from cuttings
				4	
				6	
					Medium dense, moist to wet, dark brown, poorly sorted SAND with little gravels and cobbles (SW)
32	418.1	▼	M-3-1B 1:45	8	GWE @ 8.5 feet
				10	dark brown to black sand lense 10' to 11'
				12	
19			M-3-1C 1:50		Loose, wet, dark brown SAND (SP)
				14	Bottom of Hole 14 feet.
				16	
				18	GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-3-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/20/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium dense, gray, dry, medium SAND (SP)
				2	
			M-4-1A		
				4	
				6	
					Loose, dark gray, wet, fine SAND (SP)
		▼			GWE @ 7.5 feet
	418.1		M-4-1B 3:15	8	Soft, gray, wet, fine, sandy SILT; sand has shell fragments (ML)
				10	
				12	
			M-4-1C 4:00		
				14	
					Bottom of Hole 14 feet.
				16	
				18	
					GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-4-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/21/90 Location: Shilshole Bay Marina
				0	Ground Surface
					Asphalt 2"
					Gray-brown, dry, gravelly, fine to medium SAND (SP)
				2	
			M-5-1A 8:53		Loose, gray-brown, gravelly, fine to medium SAND (SP) no odor/staining
				4	No recovery
				6	
		▼			GWE @ 7.5 feet
	418.1		M-5-1B 8:55	8	Loose, wet, fine to medium SAND, brown to gray (at 8.5') (SP) no odor/staining
				10	
				12	Medium dense, wet, gray, fine to medium SAND with shells.
			M-5-1C 9:00	14	Bottom of Hole 14 feet.
				16	
				18	GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-5

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
12			M-7-1A 1:35	2–4
10	418.1	▼	M-7-1B 1:40	6–8
7			M-7-1C 1:45	10–14

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/19/90
Location: Shilshole Bay Marina

Ground Surface

Asphalt 2"

Medium dense, damp, gray SAND (SP)

2 — — — — shell fragments

6 — — — — becoming moist

8

10 GWE @ 10 feet

— — — — saturated

12

14

Bottom of Hole 14 feet.

16

18

GWE = Groundwater encountered

20

22

24

ERM - Northwest

Boring M-7-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/19/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium dense, damp, gray SAND (SP)
				2	
					— — — shell fragments
13	418.1		M-7-2A 1:55	4	
				6	
					— — — becoming moist
11			M-7-2B 2:00	8	
		▼		10	GWE @ 10 feet
					— — — saturated
				12	
4			M-7-2C 2:10	14	
					Bottom of Hole 14 feet.
				16	
				18	
					GWE = Groundwater encountered
				20	
				22	
				24	

ERM - Northwest

Boring M-7-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/20/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Medium dense, damp, gray-brown, poorly sorted SAND. some gravels (SW)
				2	
17			SH-4-1A		
				4	
				6	- - - - grading moist sand
				8	
22		▼	SH-4-1B		GWE @ 8.5 feet
				10	
				12	
24	418.1 8240		SH-4-1C		
				14	Bottom of Hole 14 feet.
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring SH-4-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/20/90 Location: Shilshole Bay Marina
					Ground Surface
					Asphalt 2"
					Loose, damp, gray SAND, trace small cobbles/gravels, shell fragments (SW)
20			SBMn-1A 11:00	2–4	
				6	
25	8015	▼	SBMn-1B 11:05	8	GWE @ 8.5-9 feet
				10	
				12	strong odor
100			SBMn-1C 11:10	14	
					– – – – saturated
				16	
10			SBMn-1D 11:15	18	
					Bottom of Hole 19 feet.
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring SBMn-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
				0
12			SBMn-2A 1:00	2
				4
				6
220	8015	▼	SBMn-2B 1:05	8
				10
				12
1000+	8015/ 8240		SBMn-2C 1:10	14
				16
				18
				20
				22
				24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/20/90
Location: Shilshole Bay Marina

Ground Surface

Asphalt 2"

Loose, damp, gray SAND, trace small cobbles/gravels, shell fragments (SW)

GWE @ 9 feet

— — — grades black odorous sand

Bottom of Hole 14 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring SBMn-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/21/90 Location: Shilshole Bay Marina
				0	Ground Surface
					Asphalt 3"
					Dry, brown-gray, gravelly, fine to medium SAND (SP)
				2	
			SMn3-A 9:58		Medium dense, dry, gray, fine to medium SAND with shell fragments. No odor.
				4	
				6	
					Loose to medium dense, brown, fine to medium SAND, stained, with strong diesel odor.
			SMn3-B 10:02	8	Free Product at 8 feet.
		▼			GWE @ 9 feet
				10	
				12	
			SMn3-C 10:05		
				14	
				16	
					Very dense, wet, gray, fine to medium SAND (SP). Faint diesel odor.
	8015		SMn3-D 10:09	18	
				20	
				22	
			SMn3-E 10:15		Medium dense, wet, gray fine to medium SAND (SP) Heaving @ 23 1/2 feet.
				24	Bottom of Hole 24 feet.

GWE = Groundwater encountered

ERM - Northwest

Boring SBMn-3

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 5

Terminal 18

Site Location

Terminal 18 is located on the northeast corner of Harbor Island. Approximate site location is shown on the Vicinity Map, Figure 5-1.

Site Procedures

Tank assessments procedures at Terminal 18 were initiated on June 25, 1990. The tank assessed was T-18b, a 7,500 gallon diesel tank located on the northernmost portion of Terminal 18. Three borings were drilled to a maximum depth of 19 feet around Tank T-18b. (See the Boring Logs attached at end of this report section.) One boring was placed on the north, south and west sides of the tank (see Site Map, Figure 5-2).

Site Conditions

Beneath a surface layer of asphalt, the soils surrounding Tank T-18b consist of medium dense, black sand. Ground water was encountered at 10 feet below ground surface. A mild odor of petroleum hydrocarbon was noted in the soil samples during drilling. No OVA readings were recorded during the drilling of these soil borings.

Analytical Results

TLC prescreening of samples from Terminal 18 indicated that all samples collected in boring 18-1 and boring 18-2 yielded positive results. Sample 18-3A was the only sample from boring 18-3 which yielded a positive result.

The analytical results for T-18 are summarized in Table 5-1. Sample T18-2A had a value of 200 mg/kg, which is at the proposed MTCA limit for soil cleanup. The other samples submitted for laboratory analysis, T-18-1B and T-18-3D yielded TPH values below the proposed MTCA limits at 45 mg/kg and <0.5 mg/kg, respectively.

Conclusions

The TLC analyses indicate that some soil impairment may exist to depths of 14 feet in Borings 18-1 and 18-2. The laboratory analyses indicate an elevated level of contamination for sample T18-2A (at the proposed MTCA limit of 200 mg/kg) at a depth of 4 feet and located on the south side of the tank.

The field observations and analytical results do not necessarily suggest that Tank B is a leaking underground storage tank. The high TPH value may be due to spillage during filling of the tank, or from some other release associated with the tank system.

POS Preliminary Tank Assessment

POS Sampling

POS personnel performed an assessment at Terminal 18 of Tank C, a 2,500 gallon heating oil tank, and Tank P, a 2,000 gallon diesel oil tank. Soil samples were collected by POS personnel on May 25, 1990. The depth at which the samples were collected was not evident from the available drawings, nor was the depth to ground water recorded. However, based on the size of the tank, it is likely that the samples were collected at depths of between 5 and 7 feet below the surface.

POS Analytical Results

The analytical results for Tank P indicate TPH levels of 1,800 mg/kg and 5,800 mg/kg (see Table 5-1). These values are well above the proposed MTCA 200 mg/kg limit for soil cleanup.

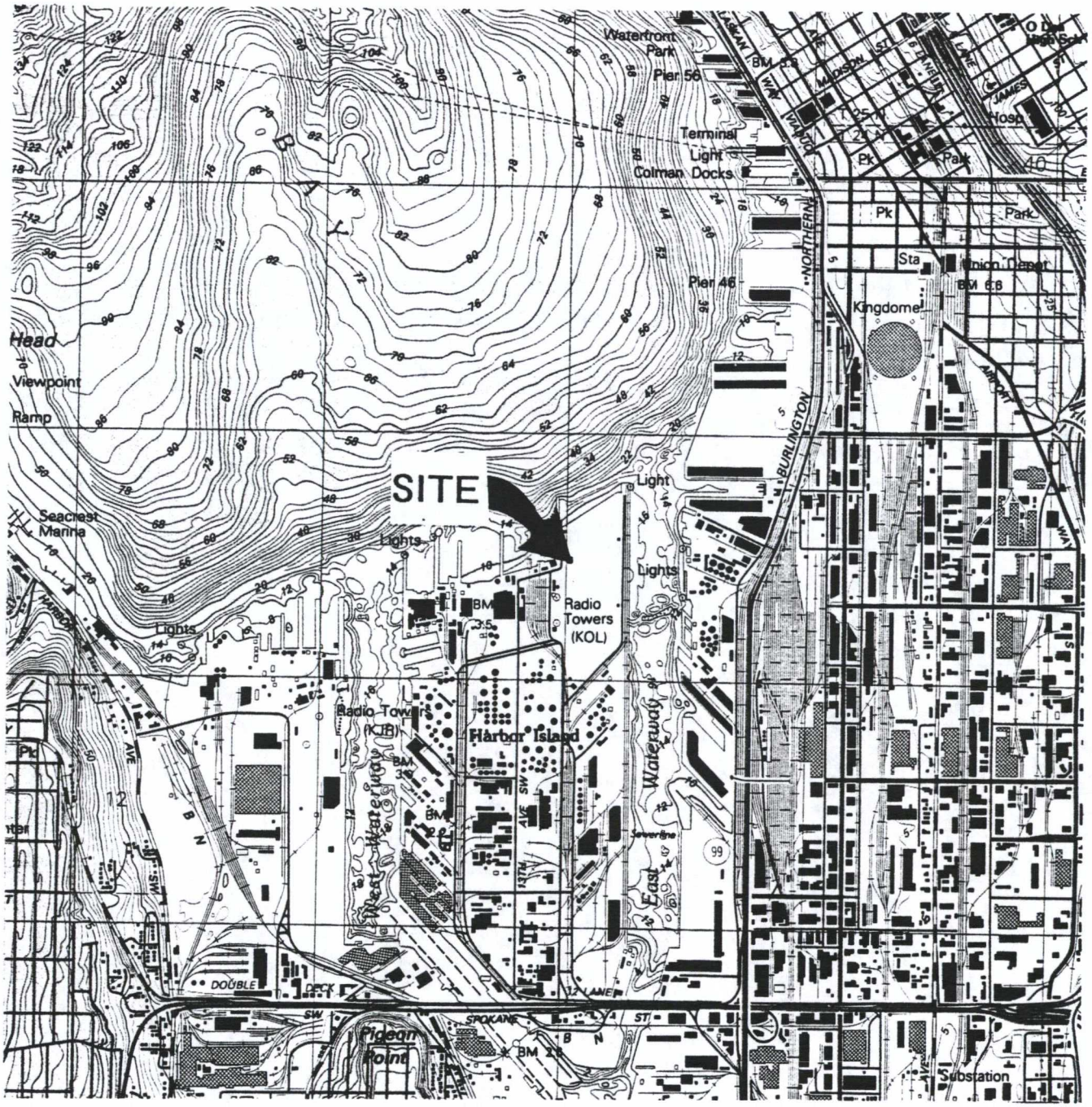
The soil sample collected from Tank C yielded a TPH level of 19 mg/kg.

Conclusions

The high TPH concentrations found at Tank P indicate significant soil contamination. Based on the lack of information, it is difficult to estimate the vertical extent of soil contamination in the area adjacent to Tank P. However, it is safe to assume that an interval of as much as 5 feet of soil has been significantly impaired by diesel fuel.

There is no indication of significant soil impairment around Tank C based on the tests performed on the sample collected from the Tank C area.

FIGURE 5-1
VICINITY MAP
TERMINAL 18



Source: 1983 USGS
Seattle South Quadrangle

State of Washington

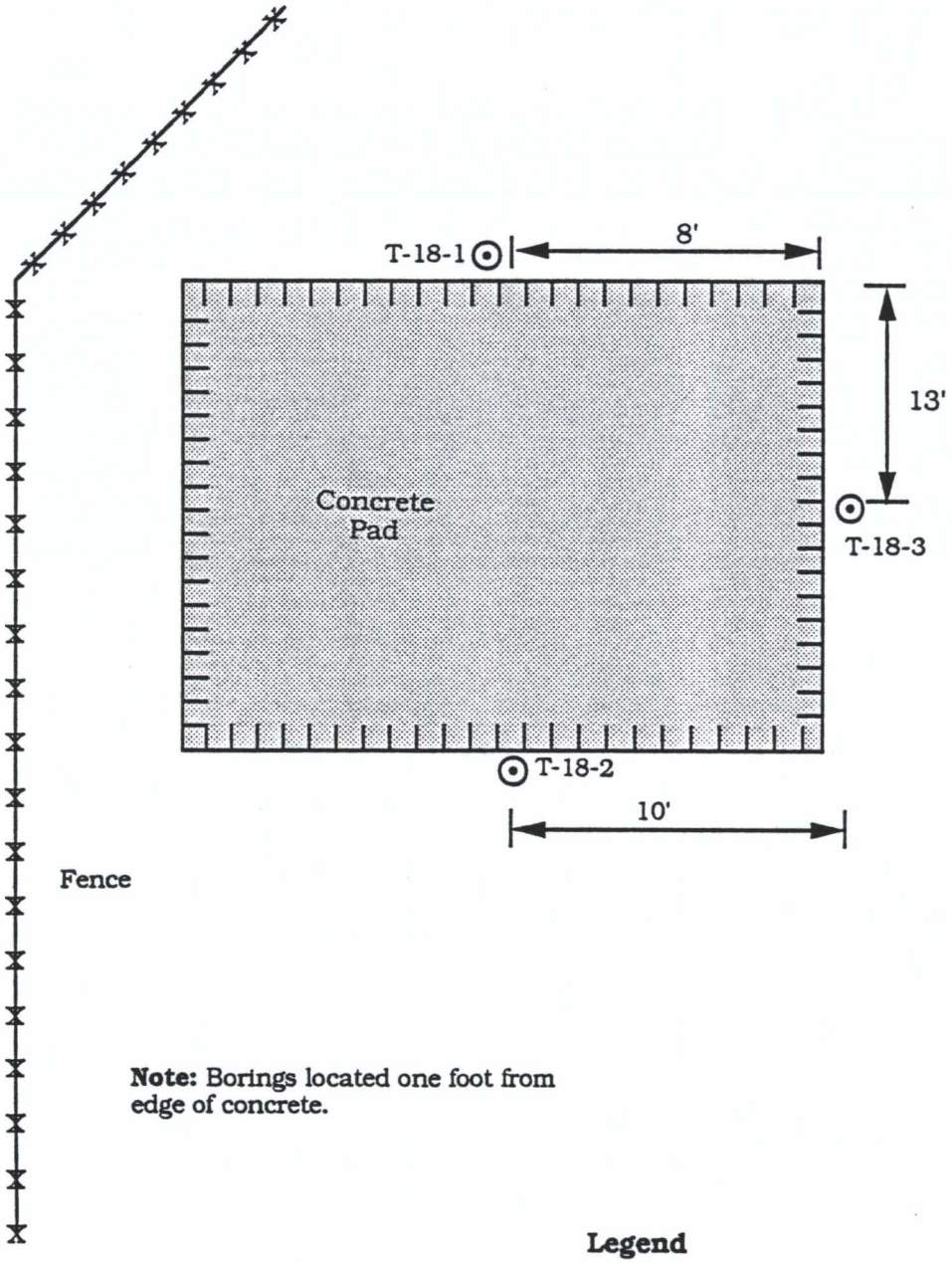
Scale 1:25 000

N

PROJECT# 64001.00

ERM

FIGURE 5-2
BORING LOCATIONS
TERMINAL 18 TANK B



Note: Borings located one foot from edge of concrete.

Legend

⊙ Boring location

N

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TABLE 5-1
Analytical Results for Terminal 18

Tank Designation: T-18b

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
T18-1B	7.5-9	45.0
T18-2A	2.5-4	200.0
T18-3D	17.5-19	<0.5

Tank Designation: T-18c and T-18p

EPA TEST METHOD 3550/418.1 (mg/kg)

Port of Seattle Sample #	Sample Interval (feet)	TPH[1] Oil & Grease
T18C East	N/A	19.0
T18P	N/A	1800.0*
T18P(W)	N/A	5800.0*

[1] TPH - Total Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
N/A - Not Available

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TERMINAL 18 BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/25/90 Location: Terminal 18
					Ground Surface
				2	Asphalt 2", 18" sandy fine gravel 12" black and gray sand
	418.1		T18-2A 10:45	4	Medium dense, moist, black, fine SAND (SP), faint oily odor
				6	
			T18-2B 10:50	8	
		▼		10	GWE @ 10 feet
				12	
			T18-2C 10:55	14	
				16	
			T18-2D 11:00	18	Wood fragments and steel nail fragments
					Bottom of Hole 19 feet.
				20	
				22	
				24	GWE = Groundwater encountered

ERM - Northwest

Boring T18-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/25/90 Location: Terminal 18
					Ground Surface
					2" asphalt, 12" sandy fine gravel 18" black and gray sand
				2	
			T18-3A 12:05		Medium dense, dry, gravelly black fine SAND (SP), slight oily odor
				4	
				6	
			T18-3B 12:10	8	Wet
		▼		10	GWE @ 10 feet
				12	
			T18-3C 12:15	14	
				16	
	418.1		T18-3D 12:20	18	
					Bottom of Hole 19 feet.
				20	
				22	
				24	
					GWE = Groundwater encountered

ERM - Northwest

Boring T18-3

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 6

Pier 66

Site Location

Pier 66 is located near the 2100 block on Elliot Avenue in Seattle. Tank D is located on the east side of Elliot Avenue, approximately 200 feet north of Lenora Street. (See Figure 6-1).

Site Procedures

Tank assessment procedures were initiated at Pier 66 on June 26, 1990. The tank of interest was Tank D, a 10,000 gallon gasoline tank. Three soil borings were drilled to a maximum of 19 feet below ground surface at this location. A fourth boring was aborted at seven feet below ground surface due to an obstruction. The borings were placed on three sides of the tank as depicted on Figure 6-2.

Site Conditions

Soils encountered at Pier 66 consisted of a medium-dense, brown silty sand, from the ground surface to a depth of approximately five feet. From five feet to nineteen feet is a medium-dense to loose silty sand interlayered with silt and sandy silt. Ground water was encountered between 8 and 12 feet below ground surface. (See the Boring Logs attached at the end of this report section).

OVA readings ranging from 35 ppm to 1,000 ppm were recorded during the drilling and sampling activities. Boring 66-1 had strong odors of petroleum hydrocarbon from ground surface to the final depth of 19 feet. A strong odor was again encountered at ground water level (minus eight feet) in Boring 3. A slight odor was observed in Boring 4.

Three soil samples: P66-1D, collected at 17.5 to 19 feet; P66-3C, collected at 12.5 to 14 feet; and P66-4B, collected at 7.5 to 9 feet were submitted for laboratory analysis from Borings 66-1, 66-3, and 66-4, respectively. Each of the samples submitted for analysis yielded values of TEPH which are above the proposed MTCA limits (100 mg/kg) for TEPH in soil. The analytical result for P66-1D was 820 mg/kg, the result for P66-3C was 310 mg/kg, and the result of the TEPH analysis for P66-4B was 670 mg/kg.

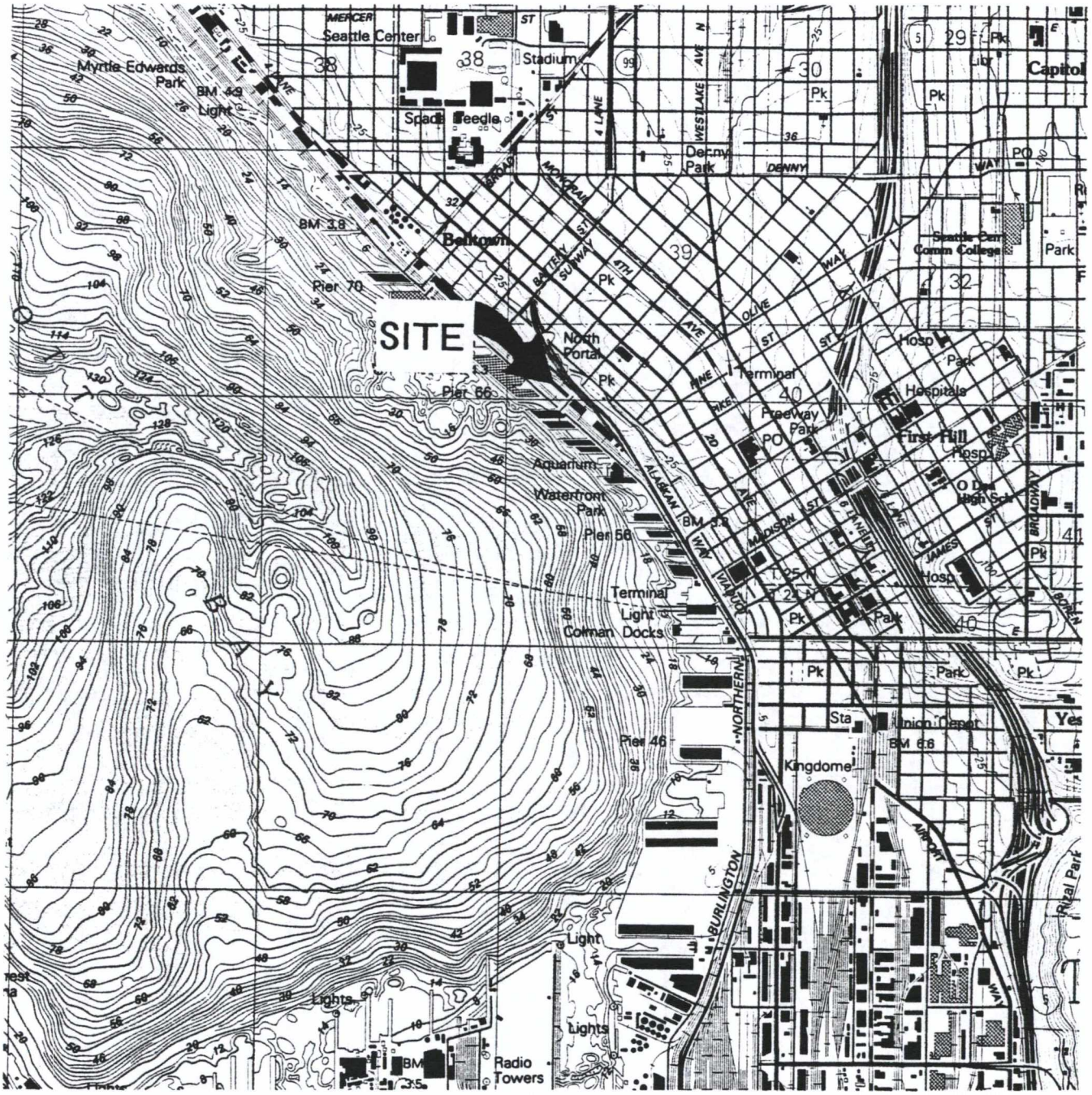
Sample P66-1D was additionally tested for VOC. The results of this analysis indicate the presence of benzene and xylene at concentrations of 1500 µg/kg and 69,000 µg/kg, respectively. These levels are above

the MTCA limits of 500 µg/kg for benzene and 20,000 µg/kg for xylene. (See Table 6-1, Analytical Results for Pier 66).

Conclusions

The analytical data and field observations from Pier 66 indicates that the Tank D underground storage tank system has potentially released product to the surrounding subsurface media. Based upon the sampling performed, impaired soil appears to extend from ground surface to at least 19 feet below ground surface. These findings suggest that ground water impairment is likely.

FIGURE 6-1
VICINITY MAP
PIER 66



Source: 1983 USGS
Seattle South Quadrangle

State of Washington

Scale 1:25 000

N

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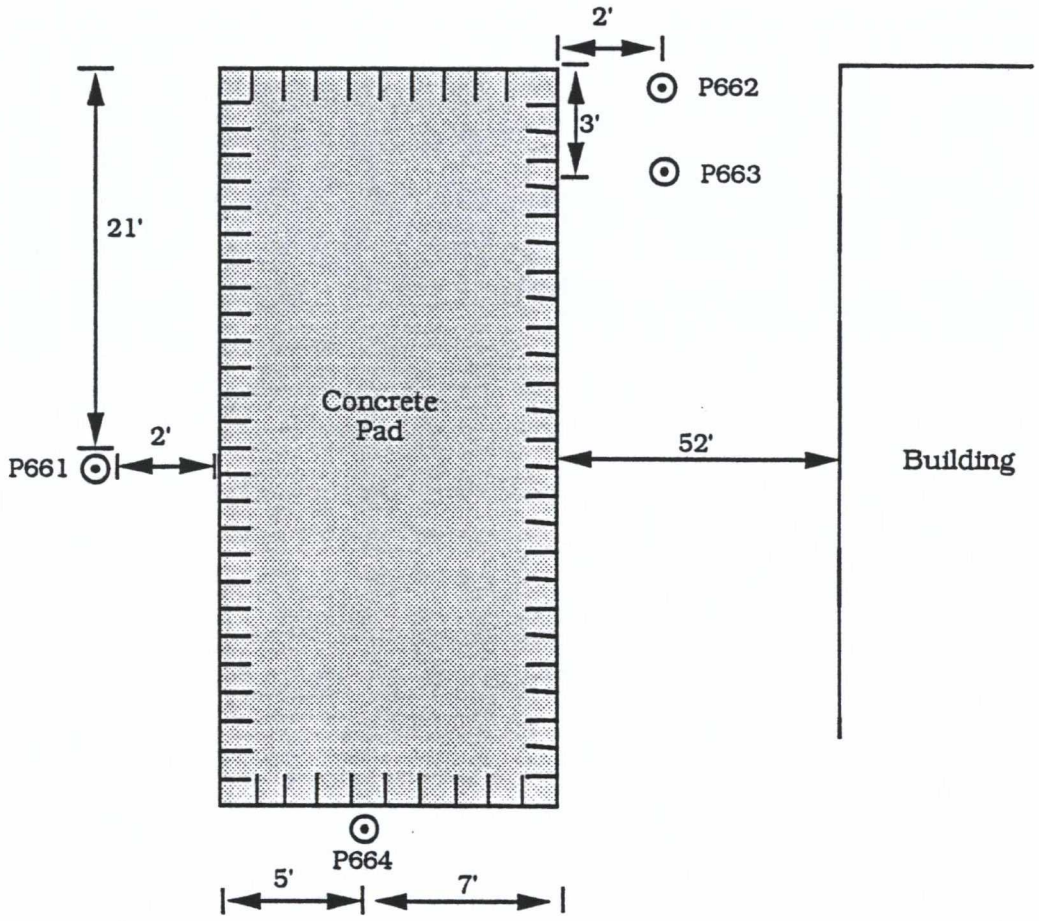
FIGURE 6-2
SITE MAP

PIER 66
TANK P66d



Legend

⊙ Boring Location

N

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ERM

TABLE 6-1
Analytical Results for Pier 66

Tank Designation: P-66D

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
P66-1D	17.5-19	820.0*
P66-3C	12.5-14	310.0*
P66-4B	7.5-9	670.0*

EPA TEST METHOD 8020 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
P66-1D	1500.0*	12,000.0	12,000.0	69,000.0*
P66-3C	ND	ND	ND	ND
P66-4B	57.0	7.1	42.0	107.0

[1] TPH - Total Petroleum Hydrocarbons
[2] TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

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PIER 66 BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/26/90 Location: Pier 66
					Ground Surface
1000+			P66-1A 8:45	2 4	Medium dense, damp, brown-gray SILTY FINE SAND, strong odor (SP-SM)
				6	Loose, moist, gray, SILTY FINE SAND, strong odor (SP-SM)
1000+			P66-1B 8:50	8	strong odor
				10	
1000+		▼	P66-1C 8:55	12	GWE @ 12 feet strong odor
				14	
				16	
1000+	8015/ 8020		P66-1D 9:00	18	strong odor
					Bottom of Hole 19 feet.
				20	
				22	GWE = Groundwater encountered
				24	

ERM - Northwest

Boring P66-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/26/90 Location: Pier 66
					Ground Surface
0			P66-2A 9:25	2	Medium dense, dry to damp, fine to coarse SAND, trace clay (SW) with iron, assorte debris, cobble
				4	
				6	
				8	Refusal at 7 feet. Bottom of Hole 7 feet.
				10	
				12	
				14	
				16	
				18	
				20	
				22	
				24	

ERM - Northwest

Boring P66-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/26/90 Location: Pier 66
					Ground Surface
					Dense, dry to damp, fine to coarse SAND with debris (SW)
				2	
				4	
				6	
					— — — grading brown to gray, moist to wet, CLAYEY SAND (SC)
		▼			GWE @ 8 feet
500			P66-3B 9:30	8	No recovery
					Medium dense, wet, gray, fine to coarse SANDY SILT, trace clay (SW-SM), wood splinters, strong odor
				10	
				12	
1000+	8015/ 8020		P66-3C 9:35	14	
				16	Loose, wet, brown to gray, fine to coarse CLAYEY SAND, little odor (SW-SC)
			P66-2D 9:40	18	— — — No recovery. Grab from inside auger. This material appears clean.
					Bottom of Hole 19 feet.
				20	
				22	GWE = Groundwater encountered
				24	

ERM - Northwest

Boring P66-3

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/26/90 Location: Pier 66
					Ground Surface
					Loose, damp to wet, gray-brown, fine to coarse CLAYEY SAND (SW-SC)
				2	
120			P66-4A 11:25		
				4	Loose, moist, gray, silty fine SAND/fine sandy SILT (SP-SM), brick pieces
				6	
		▼			GWE @ 7.5 feet
85	8015/ 8020		P66-4B 11:20	8	
					grading wet
				10	
70			P66-4C 11:25	12	Hard, brown-gray fine SANDY SILT (ML)
				14	
				16	
					Loose, coarse SAND , little odor (SP) cleans up at 17' - less discoloration
35			P66-4D 11:30	18	
					Bottom of Hole 19 feet.
				20	
				22	GWE = Groundwater encountered
				24	

ERM - Northwest

Boring P66-4

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 7

Horton Street Maintenance Shop

Site Location

The Horton Street Maintenance Shop is located on Horton Street in Seattle, one block east of Alaskan Way and adjacent to the north side of Spokane Street. The approximate site location is shown on the Vicinity Map, Figure 7-1.

Site Procedures

Tank assessment procedures for two 500 gallon waste oil tanks located at the Horton Street facility were performed on June 27 and 29, 1990 The assessment program consisted of drilling a total of four soil borings and collecting soil samples at selected intervals. The POS tank designations are CW-100d and CW-100dd.

Tank CW-100dd is located adjacent to the southwest portion of the maintenance shop building. Soil borings DD1 and DD2 were excavated to respective depths of 14 feet and 4.5 feet below ground surface and located along the east and west sides of the tank. A subsurface obstruction was encountered during the advancement of DD2. This obstruction prevented the achievement of the depth desired. Due to the numerous underground utilities and identified lines in this area, an additional boring was not attempted.

Tank CW-100d is located west of the site structure and east of the northwest property boundary. Soil borings D1 and D2 were drilled to depths of 14 feet below surface grade and situated east and south of the tank perimeter.

The tank areas and approximate soil boring locations are shown on Site Maps, Figure 7-2 (Tank CW-100dd) and Figure 7-3 (Tank CW-100d).

Site Conditions

The boring logs, attached at the conclusion of this section, describe the subsurface soils encountered at the Horton Street Maintenance facility as consisting generally of sandy silts and silty sands. Specifically, the soils are described as soft, moist sandy silts and loose to medium dense, moist to wet, silty sands with occasional cobbles and gravel. During the drilling of borings D1 and D2, a 0.5 foot section

of concrete was encountered beneath the uppermost 0.5 foot section of fill material. Ground water was encountered in borings DD1, D1 and D2 at depths ranging from 8 to 9 feet below ground surface.

Significant visual indications of soil contamination were observed during the excavation of borings D1 and D2. OVA headspace analyses indicated that the soils possessed elevated concentrations of organic vapors (>1000 ppm). The physical characteristics and appearance of the soil resembled a chemical constituent more volatile than waste oil and similar to diesel or kerosene.

Analytical Results

Ten samples were collected from the borings excavated at the Horton Street Maintenance facility. One sample each from borings DD1, D1 and D2 was analyzed for TPH. The analytical laboratory results are described below and summarized in Table 7-1 of this section.

TLC analyses were performed only for the samples collected at the Tank CW-100dd location. The TLC tests yielded a positive result for sample DD2-A (4 feet below surface). Samples A, B and C from boring DD1 all yielded negative results. TLC testing was not conducted for samples collected at the Tank CW-100d location.

Tank CW-100dd

Laboratory analysis was performed for the presence of TPH on sample DD1-B (9 feet below surface). The test result exhibited a trace concentration (0.7 mg/kg) of TPH significantly below the proposed MTCA limit.

Tank CW-100d

TPH analysis was performed on samples obtained from both D1 and D2. Sample D1-C (14 feet below surface) yielded a TPH concentration below the laboratory detection limit. Sample D2-A (6 feet below surface) exhibited a TPH concentration of 1600 mg/kg. This result is well above the proposed MTCA limit for TPH as diesel in soil (200 mg/kg).

Conclusions

The analytical laboratory and TLC test results of DD1-B (9 feet below surface) and DD2-A (4 feet below surface), along with the soil descriptions of DD1 and DD2 suggest that trace concentrations of waste oil may exist in the upper portions of subsurface soils surrounding Tank CW-100dd. However, available information did not

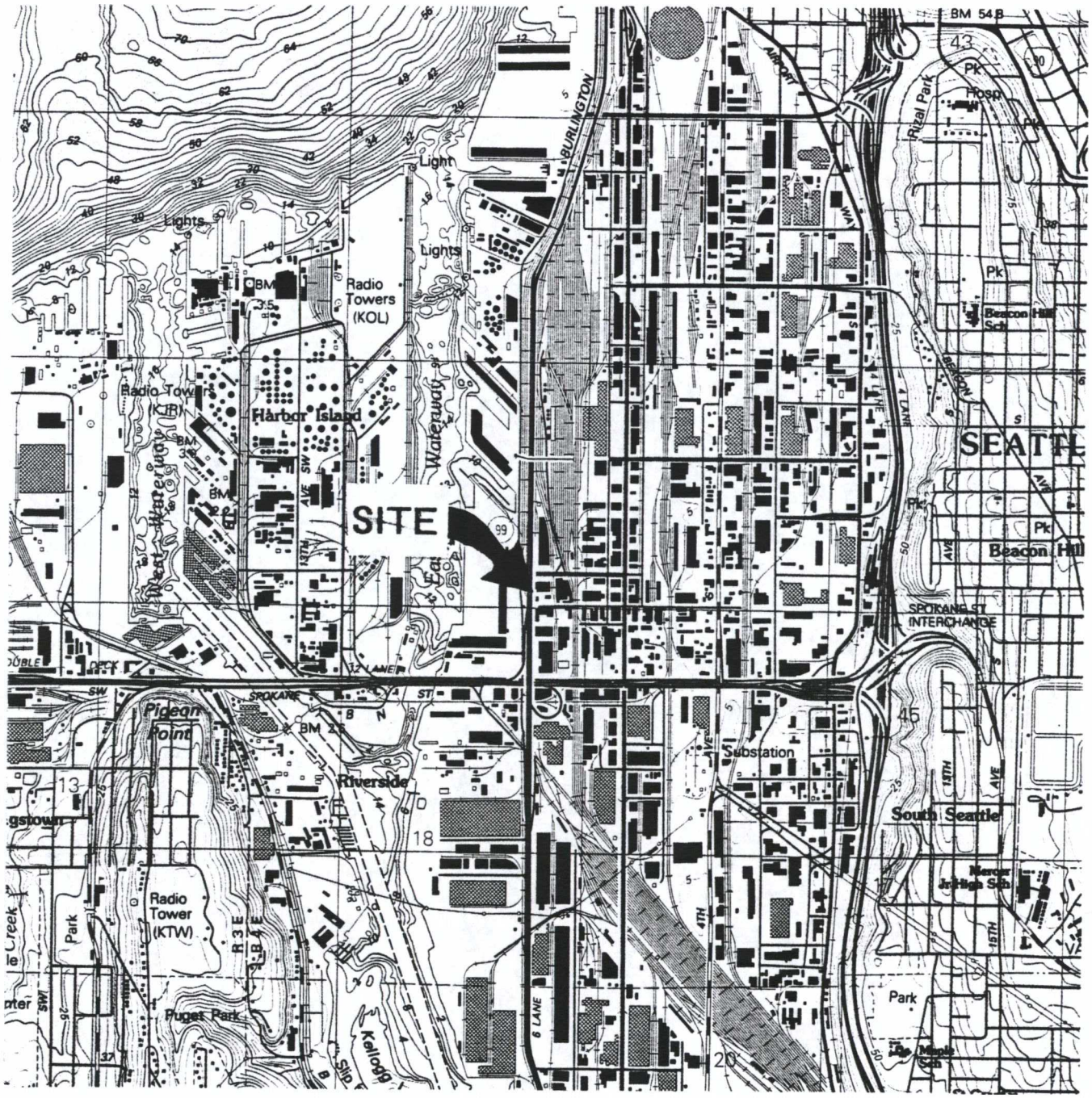
reveal concentrations exceeding those promulgated in the proposed MTCA limits.

The analytical results suggest that Tank CW-100d has released product to the surrounding subsurface media. Field monitoring and observations indicate that the subsurface soils in this area are contaminated from the release of a volatile chemical constituent other than waste oil. The information obtained from field and laboratory results indicate that TPH contamination, in varying concentrations, is likely to extend from depths of 2 feet below surface to 12 feet below surface. Based on these results, it is likely that ground water impairment exists.

FIGURE 7-1

VICINITY MAP

HORTON STREET MAINTENANCE SHOP



Source: 1983 USGS
Seattle South Quadrangle

Site Location

State of Washington

Scale 1:25 000

N

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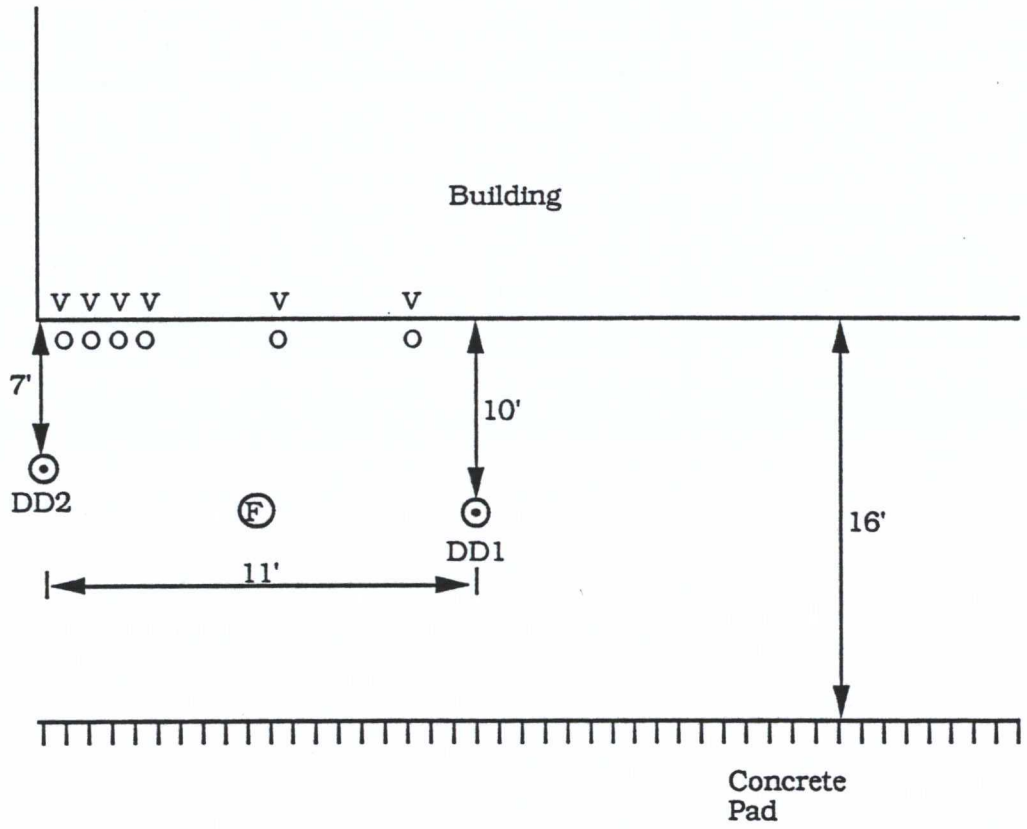
FIGURE 7-2
SITE MAP

HORTON STREET MAINTENANCE SHOP
TANK CW-100dd



Legend

- (F) Fill Port
- O V Vent Pipe
- ⊙ Boring Location

N

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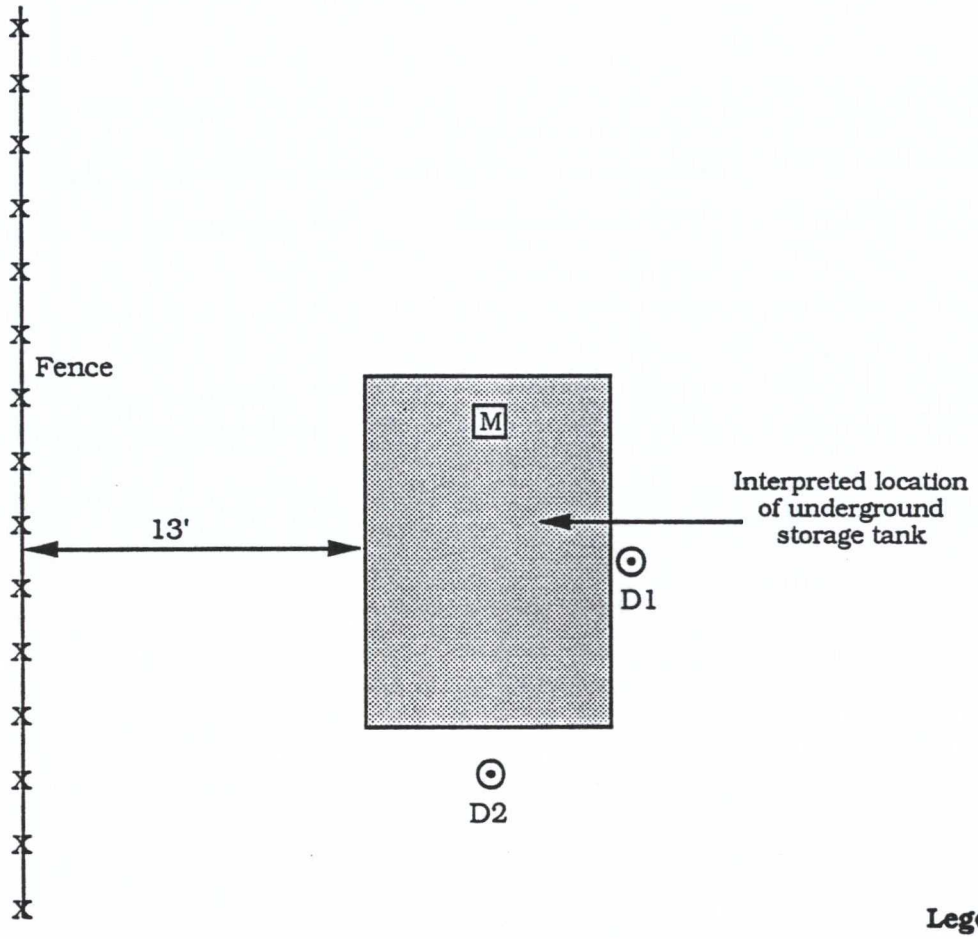
FIGURE 7-3
SITE MAP
HORTON STREET MAINTENANCE SHOP
TANK CW-100d



Legend

⊙ Boring Location

M - Waste Oil Tank Manway

N

NOT TO SCALE

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TABLE 7-1
Analytical Results for Horton Street Maintenance Shop

Tank Designation: CW-100dd

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
DD1-B	7.5-9	0.7

Tank Designation: CW-100d

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
D1-C	12.5-14	<0.5
D2-A	4.5-6	1600.0*

[1] TPH - Total Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm

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HORTON STREET MAINTENANCE SHOP
BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/29/90 Location: Horton St. Maintenance Shop
					Ground Surface
					Asphalt 2"
					Dense, damp, brown, fine to medium SAND with 3/4" gravels (SP)
					6" concrete
				2	Soft, moist, gray to brown very fine SANDY SILT (ML)
				4	— — — — strong gas odor
1000			D1-A 9:00		Medium dense, moist, black, fine SILTY SAND (SP-SM)
				6	— — — — grading wet
1000		▼	D1-B 9:05	8	GWE @ 8 feet
				10	
				12	
1000	418.1		D1-C 9:10	14	Bottom of Hole 14 feet.
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring D1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/29/90 Location: Horton St. Maintenance Shop
					Ground Surface
					Asphalt 2"
					Dense, damp, brown, fine to medium SAND with 3/4" gravels (SP)
					6" concrete core
				2	Soft, moist, black, very fine sandy SILT , strong gasoline odor (ML)
					Loose, moist, black, very fine SILTY SAND, strong odor (SP-SM)
				4	
1000	418.1		D2-A 9:30		
				6	
					— — — — becomes wet with strong gasoline odor
		▼			
1000			D2-B 9:35	8	GWE @ 8 feet
				10	
				12	
70			D2-C 9:40		
				14	
					Bottom of Hole 14 feet.
				16	
				18	
				20	
					GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring D2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 6/27/90 Location: Horton St. Maintenance Shop
					Ground Surface
					Asphalt 2"
				2	Loose, light gray-brown, damp, fine SILTY SAND (some rocks/gravels to 3 feet) (SP-SM)
				4	
			DD1-A 9:50		Very loose, black, moist, fine SILTY SAND (SP-SM)
				6	
	418.1	▼	DD1-B 10:15	8	Becomes wet at 8 feet.
					GWE @ 9 feet
				10	
				12	
			DD1-C 10:20		
				14	
					Bottom of Hole 14 feet.
				16	
				18	
				20	GWE = Groundwater encountered
				22	
				24	

ERM - Northwest

Boring DD1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
			DD2-A	2 4 6 8 10 12 14 16 18 20 22 24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 6/27/90
Location: Horton St. Maintenance Shop

Ground Surface

Asphalt 2"

Damp, light brown, fine to medium SILTY SAND, trace cobbles (SP-SM)

Grades dark brown to black

Grab sample from auger flight

Bottom of Hole at 4.5 feet.

ERM - Northwest

Boring DD2

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 8

Sea-Tac Airport-PanAm Hanger

Site Location

The PanAm Hanger is located between the south end of Concourse A and the Northwest Airlines Hanger at the Seattle Tacoma International Airport. (See Figure 8-1).

Site Procedures

On July 2-3,1990, six underground storage tanks at the PanAm hanger were investigated. The tanks are generally located southeast and west of the east/southeast portion of the hangar building. The tanks are situated in an east (Tank 10f) to west (Tank 10J) alignment and extend in the order presented below. In addition, the tank identifications, capacity and chemical constituent are listed.

Tank 10f - 2000 gallon gasoline fuel tank
Tank 10G - 1000 gallon ethylene glycol tank
Tank 10H - 8000 gallon kerosene tank
Tank 10e - 8000 gallon diesel fuel tank
Tank 10i - 8000 gallon mineral spirits tank
Tank 10J - 2000 gallon waste oil tank

Twelve subsurface soil borings were excavated during the course of the field investigation. With the exception of 10e-1, the soil borings were drilled to maximum depths of 18 feet below ground surface. Eleven soil borings were excavated along the north and south tank perimeters. The additional boring was placed adjacent and to the west of the fuel and chemical dispensing pumps. The pumps are situated adjacent to the southwest outside wall portion of the building. Dense soil conditions encountered during the advancement of 10e-1 prevented the boring from obtaining the desired depth. Refusal to advance10e-1 was encountered at a depth of 9 feet below ground surface. The soil boring locations are shown on the Site Map, Figure 8-2.

Site Conditions

The subsurface soils at the PanAm Hanger consisted of very dense, silty sand with cobbles and gravel scattered throughout. In addition to gravelly, silty sand and lenses of gravel, interbedded sandy silts were encountered. Groundwater was not encountered during the PanAm drilling operations. The boring logs are presented at the conclusion of this section.

Chemical and gasoline odors and discolored soils indicative of soil impairment were observed in soil borings 10f-1, 10f-2 and 10H-1. Significant OVA readings, ranging from 75 to 1000 ppm, were detected only during the excavation of borings 10f-1 and 10f-2. These OVA readings are noted on the boring logs.

Analytical Results

The following information summarizes the results of TEPH, BTEX, VOC and TPH laboratory analyses performed for select soil samples subsequent to the PanAm sampling program.

TEPH and BTEX analyses were performed for samples 10f-1B (13 feet below ground surface), 10f-2C (18 feet below ground surface), 10H-2B (14 feet below ground surface), 10H-3A (8 feet below ground surface), 10i-1B (13 feet below ground surface) and 10i-2C (18 feet below ground surface). The results indicate detectable concentrations of TEPH in samples 10f-1B, 10f-2C and 10i-2C with detectable levels of BTEX present in 10f-1B and 10f-2C. Sample 10f-1B yielded a TEPH concentration of 670 mg/kg and exceeded the proposed MTCA allowable limits. No BTEX concentrations were above the proposed limits.

VOC analyses were performed on samples 10H-1A (8 feet below ground surface) and 10G-1A (8 feet below ground surface). Detectable and trace levels of acetone, methylene chloride, ethylbenzene and xylene were present. The low levels of acetone and methylene chloride are suspected to be of laboratory origin.

TPH analyses were performed on samples 10e-1A (8 feet below ground surface), 10e-2B (13 feet below ground surface), 10J-1B (13 feet below ground surface) and 10J-2A (9 feet below ground surface). Trace concentrations of TPH (2.0 to 6.5 mg/kg) were detected in all samples.

Conclusions

The laboratory results, field monitoring and observations indicate that the Tank 10f system has released product to the surrounding subsurface media. The data from Boring 10f-1 suggest that contamination extends to a depth of at least 13 feet below ground surface. The field measurements obtained during Boring 10f-2 suggest that the contamination may extend as deep as 18 feet below ground surface.

During the excavation of Boring 10H-1, significant soil discoloration was observed and odors encountered. 10H-1 was situated immediately adjacent to the ethylene glycol chemical dispensing pump.

Sea-Tac Airport-Fire Department

Site Location

The Sea-Tac Fire Department is located just north of the Main Terminal North Satellite. The waste oil tank, 14e, is located on the southeast corner of the engine house (see Figure 8-1).

Site Conditions

A 241 gallon waste oil tank at the Sea-Tac Fire Department was investigated on July 5, 1990. Two soil borings were drilled to a depth of 12 feet at this location. The soil encountered around this tank was silty sand, with some interbedded clay and gravel. Groundwater was not encountered during the excavation of the borings

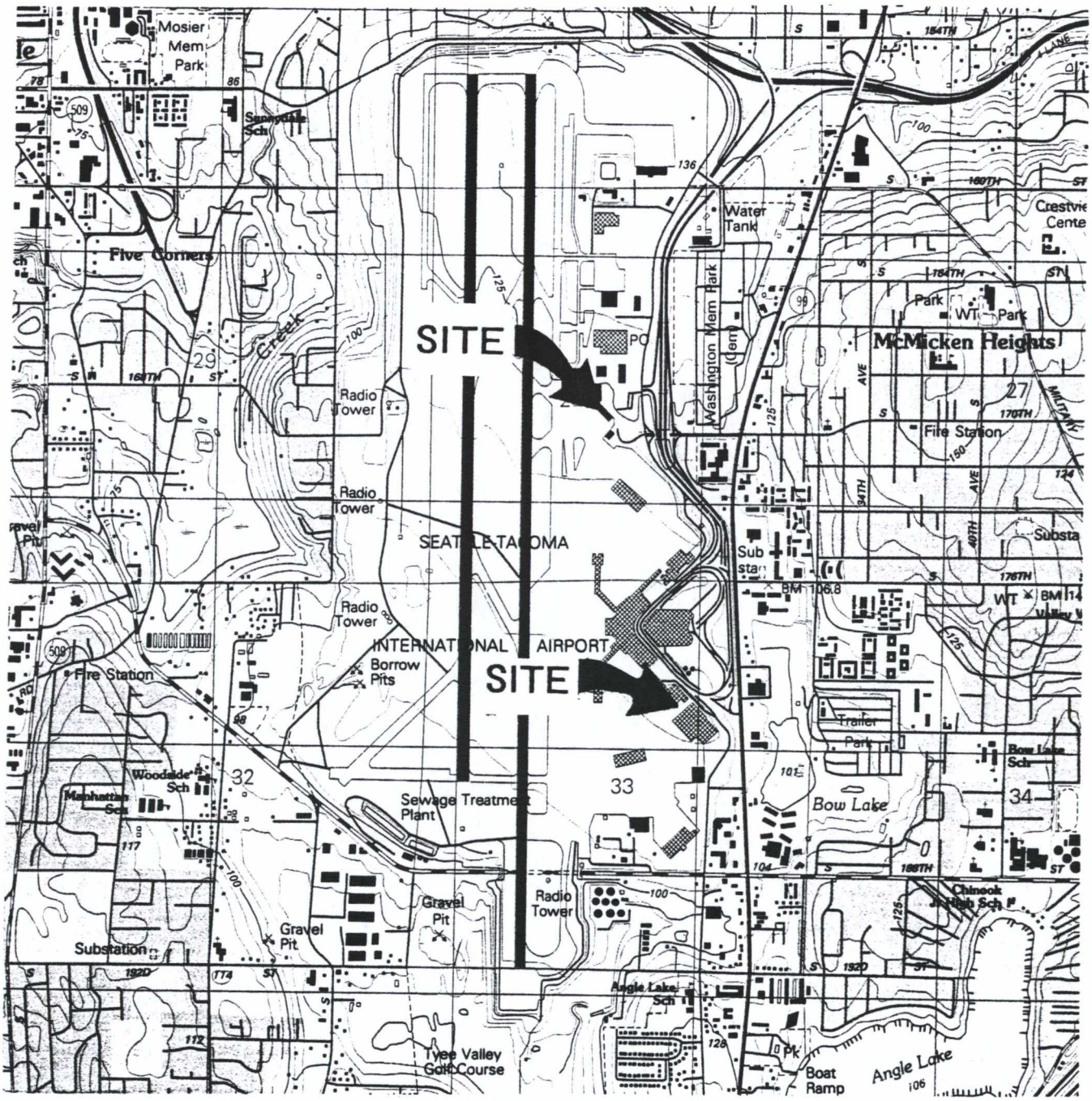
One soil sample from each boring was submitted for TPH analysis. No odors and no OVA readings were noted or recorded during the drilling and sampling activities.

Analytical Results - Low (below MTCA levels) levels of TPH were detected in the soil samples submitted for analysis.

Conclusion

Analytical data from soil samples collected at the fire station adjacent to the waste oil tank do not suggest that this is a leaking underground storage tank. Refer Table 8-1, Analytical Results for the Sea-Tac Fire Station for an analytical summary.

FIGURE 8-1
VICINITY MAP
SEA-TAC AIRPORT



Source: 1983 USGS
Burien Quadrangle

Site Location

State of Washington

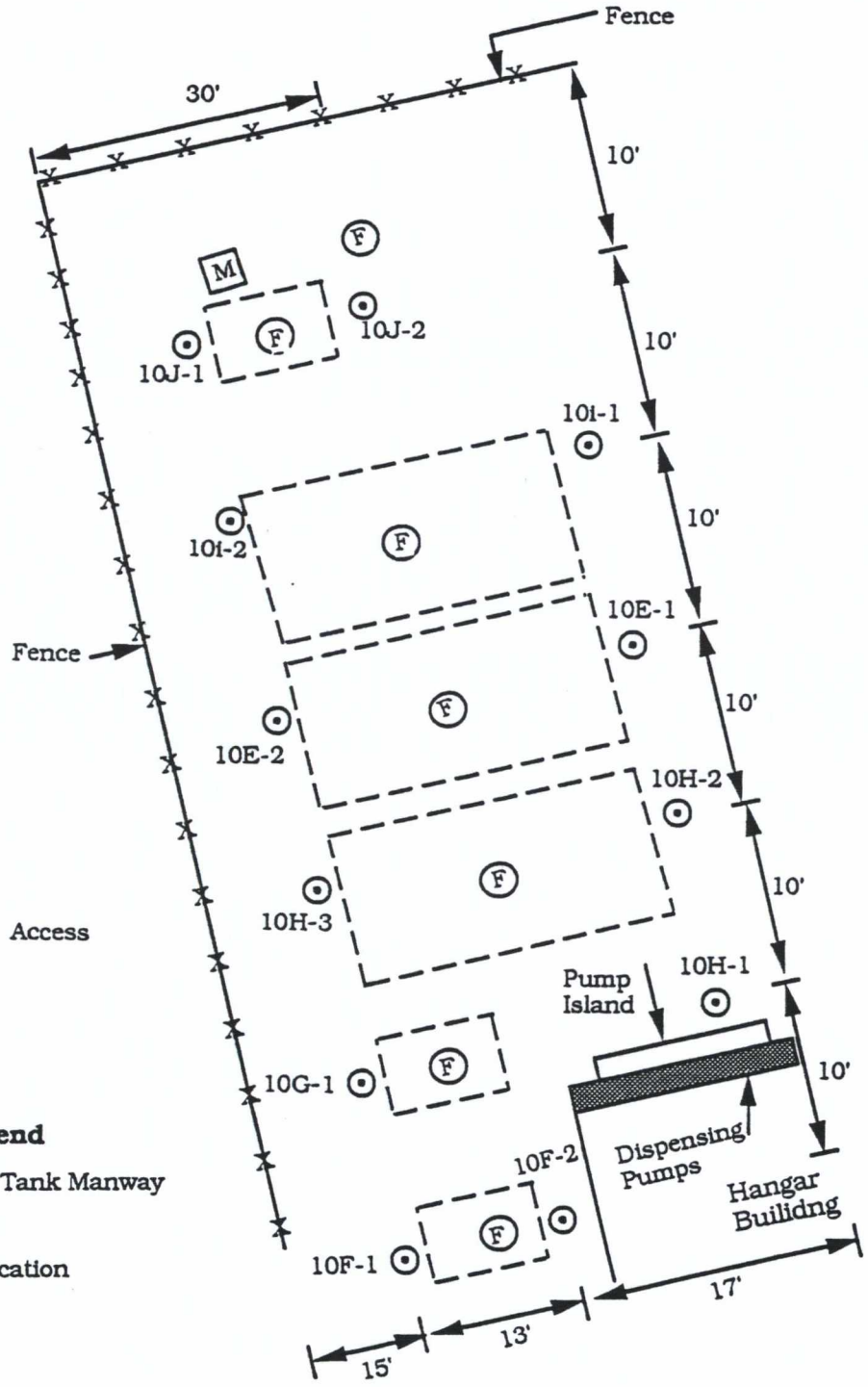
Scale 1:25 000

N

PROJECT# 64001.00

ERM

FIGURE 8-2
SITE MAP
SEATAC AIRPORT/PAN AM HANGER



Legend

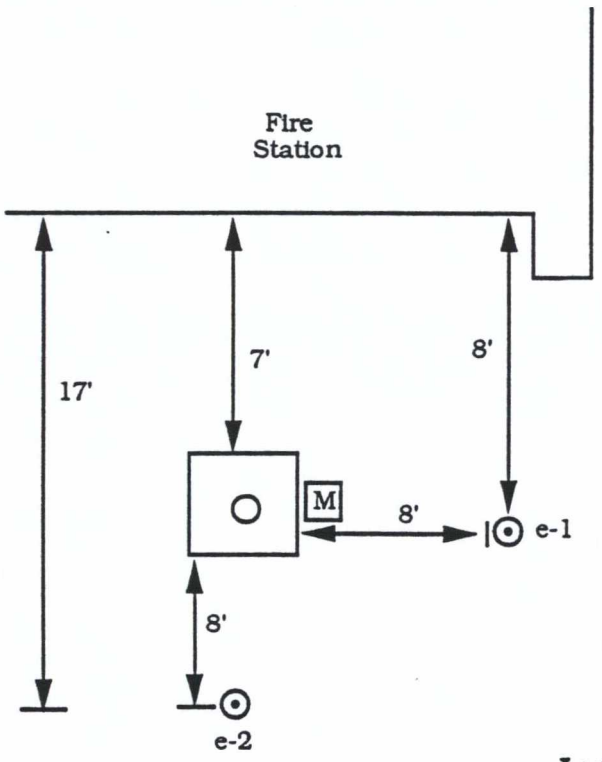
- M — Waste Oil Tank Manway
- F — Fill Port
- ⊙ — Boring Location

NOT TO SCALE

PROJECT# 64001.00

ERM

FIGURE 8-3
BORING LOCATIONS
SEATAC AIRPORT/FIRE DEPARTMENT
TANK 14E



Legend

M - Waste Oil Tank Manway

⊙ Boring Location

N

NOT TO SCALE

PROJECT# 64001.00

ERM

TABLE 8-1
Analytical Results for PanAm Facility at Sea-Tac Airport

Tank Designation: 10H

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
10H-2B	12.5-14	<2.0
10H-3A	7.5-9	<2.0

EPA TEST METHOD 8020 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
10H-2B	<1.0	<1.0	<1.0	<1.0
10H-3A	<1.0	<1.0	<1.0	<1.0

EPA TEST METHOD 8240 (µg/kg)

ERM-NW Sample #	Acetone	Ethyl-benzene	Methylene Chloride	Total Xylene
10H-1A	33.0	5.1	6.5	5.7

1 TPH - Total Petroleum Hydrocarbons
2 TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

The ERM Group

Tank Designation: 10e

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
10E-1A	7.5-8	6.5
10E-2B	12.5-13	4.0

Tank Designation: 10f

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
10F-1B	12.5-13	670.0*
10F-2C	17.5-18	59.0

EPA TEST METHOD 8020 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
10F-1B	ND	230.0	1800.0	15,500.0
10F-2C	ND	ND	ND	7.8

Tank Designation: 10G

EPA TEST METHOD 8240 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	Acetone	Methylene Chloride	Total Xylene
10G1-A	7.5-8	43.0	3.4	1.7

[1] TPH - Total Petroleum Hydrocarbons
[2] TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

The ERM Group

Tank Designation: 10i

EPA TEST METHOD 8015 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TEPH[2]
10i-1B	12.5-13	ND
10i-2C	17.5-18	20.0

EPA TEST METHOD 8020 (µg/kg)

ERM-NW Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
10i-1B	ND	ND	ND	ND
10i-2C	ND	ND	ND	ND

Tank Designation: 10J

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
10J-1B	12.5-13	4.3
10J-2A	7.5-9	2.0

[1] TPH - Total Petroleum Hydrocarbons
[2] TEPH - Total Extractable Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb

TABLE 8-2
Analytical Results for Sea-Tac Fire Station

Tank Designation: 14E

EPA TEST METHOD 418.1 (mg/kg)

ERM-NW Sample #	Sample Interval (feet)	TPH[1]
14E-1A	6-7.5	23.0
14E-2B	10.5-12	8.3

[1] TPH - Total Petroleum Hydrocarbons
mg/kg = ppm

The ERM Group

SEA-TAC AIRPORT BORING LOGS

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet
	418.1		10e-1A 11:30	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24

GEOLOGIC LOG

Driller: Hokkaido
Completion Date: 7/2/90
Location: Sea Tac/Pan Am Hanger

Ground Surface

Asphalt 2"

Damp. brown, fine to medium SILTY SAND/fine SANDY SILT with trace cobbles (SP-SM)

— — — — grading light brown

— — — — grading very dense fine SANDY SILT, no odor (ML)

Refusal at 9 feet.

1st 10e-1 - refusal at 3.5 feet - moved 1.5 - 2.0 feet south.
2nd 10e-1 - refusal at 9.0 feet.

ERM - Northwest

Boring 10e-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Very dense, damp, brown, fine to medium SILTY SAND, gravels and cobbles (SP-SM)
				2	
				4	
				6	
			10e-2A 12:40	8	
				10	
	418.1		10e-2B 1:00	12	
				14	
				16	
			10e-2C 1:05	18	
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10e-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/2/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Very dense, damp, brown, fine to medium SILTY SAND (SP-SM)
				2	
				4	
				6	— — — — grading gray SILTY SAND, strong odor
1000+			10f-1A 3:20	8	
				10	
	8015/ 8020		10f-1B 3:30	12	
				14	
				16	
					— — — — Hard, brown, very fine SANDY SILT (ML)
			10f-1C 3:35	18	
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10f-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Asphalt 2"
					Very dense to hard, damp, brown, very fine SANDY SILT/SILTY SAND (ML)
				2	
				4	grading gray odorous SANDY SILT, with increased amounts of gravels to 19' (ML)
				6	
150			10f-2A 8:10	8	
				10	
				12	
75			10f-2B 8:15		
				14	
					grading trace of rock/gravel
				16	
					grading to brown
90	8015/ 8020		10f-2C 8:25	18	
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10f-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
				2	Very dense, damp, brown to light brown SILTY SAND/very SANDY SILT with some gravels (SP-SM)
				4	
				6	
	8240		10G-1A 9:20	8	
				10	grading brown, fine to medium SILTY SAND, with some gravels (SP-SM)
				12	
			10G-1B 9:30	14	
				16	grading gray-brown, moist, fine to medium SILTY SAND, trace gravels
			10G-1C 9:40	18	Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10G-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/2/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Asphalt 2"
				2	Damp, brown, fine to medium SILTY SAND/fine SANDY SILT with trace cobbles (SP-SM/ML)
					— — — grading light brown
				4	Hard fine SANDY SILT, no odor (ML)
				6	
	8240		10H-1A 10:25	8	
				10	
				12	
			10H-1B 10:35	14	
				16	
					Very dense, mottled, light brown, silty SAND (SM)
			10H-1C 10:45	18	
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10H-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/2/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Very dense, damp, light brown, fine to medium SILTY SAND, some cobbles (SP-SM)
				2	
				4	
				6	
			10H-2A 11:05	8	no odor
				10	
				12	
	8015/ 8020		10H-2B 11:15	14	no odor
				16	
			10H-2C 11:25	18	no odor
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10H-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Very dense, damp, brown to gray-brown, fine to medium SILTY SAND with some gravels (SP-SM)
				2	
				4	
				6	
	8015/ 8020		10H-3A 11:30	8	— — — grading into more gravels/cobbles
				10	
					Very dense, damp, brown, fine to medium SAND with some silt (SP-SM)
			10H-3B 11:40	12	
				14	Hard, damp, gray-brown, very fine SANDY SILT with trace gravels (ML)
				16	
			10H-3C 11:50	18	Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10H-3

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/2/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Asphalt 2"
				2	Very dense, damp, brown, fine to medium SILTY SAND/very fine SANDY SILT (SP-ML)
				4	
				6	
			10i-1A 2:20	8	
				10	
				12	> 3" cobble
	8015/ 8020		10i-1B 2:25	14	grading 50% cobbles 3/4" - 3" gravels
				16	
			10i-1C 2:30	18	
					Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10i-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Very dense, moist, fine to medium SILTY SAND (some cobble) (SP-SM)
				2	
				4	
				6	
			10i-2A 1:30	8	
				10	— — — grading more gravels/cobbles
				12	
			10i-2B 1:40	14	
				16	— — — grading smaller gravels
	8015/ 8020		10i-2C 1:45	18	Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10i-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
				2	Very dense, damp, brown, fine to medium SILTY SAND, some cobbles/gravels, no odo (SP-SM)
				4	
				6	
			10J-1A 2:15	8	
				10	
				12	Very dense, damp, gray-brown SAND, trace silt, no odor (SP)
	418.1		10J-1B 2:20	14	
				16	Very dense, moist, brown, fine to medium SILTY SAND/SANDY SILT, no odor (SP-SM)
			10J-1C 2:25	18	Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10J-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/3/90 Location: Sea Tac/Pan Am Hanger
					Ground Surface
					Medium dense, damp, light brown to brown, fine to medium SAND, with trace silt and gravel (SP)
				2	
				4	
				6	
	418.1		10J-2A 1:50	8	
				10	
				12	grading more silt and cobble
			10J-2B 1:55		
				14	Dense, damp, brown, fine to medium SILTY SAND (SP-SM)
				16	
			10J-2C 2:00	18	Bottom of Hole 18 feet.
				20	
				22	
				24	

ERM - Northwest

Boring 10J-2

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/5/90 Location: Sea Tac/Fire Department
					Ground Surface
					Concrete 12"
					Gravels 4"
				2	Damp, brown, fine to medium SILTY SAND, some gravels (SP-SM)
				4	
				6	Medium dense, damp to wet, brown, fine to medium SILTY SAND, some CLAY (SP-SM)
	418.1		14e-1A 1:15		6" gray, fine to medium SILTY SAND (SP-SM)
				8	Medium dense, moist, brown, fine to medium CLAYEY SAND with trace gravels (SP-SC)
				10	
			14e-1B 1:25	12	Bottom of Hole 12 feet.
				14	
				16	
				18	
				20	
				22	
				24	

ERM - Northwest

Boring 14e-1

POS Preliminary Tank Assessment
Seattle, Washington

BORING LOG

OVA Reading (ppm)	Analyses Performed	Water Level	Sample No./ Time	Depth in Feet	GEOLOGIC LOG
					Driller: Hokkaido Completion Date: 7/5/90 Location: Sea Tac/Fire Department
					Ground Surface
					Concrete 12" Gravels 4"
				2	Damp, brown, fine to medium SILTY SAND, trace clay, some gravels (SP-SM)
				4	
				6	
			14e-2A 1:50		Medium dense, damp to wet, gray, fine to medium SILTY SAND, trace clay (SP-SM)
				8	
				10	
	418.1		14e-2B 2:00	12	
					Bottom of Hole 12 feet.
				14	
				16	
				18	
				20	
				22	
				24	

ERM - Northwest

Boring 14e-2

POS Preliminary Tank Assessment
Seattle, Washington

SECTION 9

POS Sampling

Terminal 30

Site Location

Terminal 30 is located on the East Waterway, west of East Marginal Way South.

Site Procedures

POS personnel conducted soil sampling at Terminal 30 for Tanks 30a, a 1000 gallon gasoline tank, and Tank 30aa, a 1000 gallon diesel tank. Samples were collected on May 14 and 15, 1990. Soil samples for chemical analysis were collected from trenches excavated adjacent to the tanks. The analytical laboratory results were submitted to ERM-NW for review.

Site Conditions

The available drawing indicates that the tanks are situated within a single excavation. Fuel impaired soils from 6 inches to the excavation bottom were observed. The soils were described as gray and odorous. The depth from which the samples were collected was not noted, except that each were collected from close to the bottom of the tank. Based on the size of the tanks it is surmised that the samples were collected at depths at approximately 6 to 8 feet below ground surface. No ground water information was provided.

Analytical Results

The soil samples were analyzed for TPH (oil and grease), and BETX. Analytical results indicate that the TPH levels in the soil are above the proposed MTCA soil cleanup limits for both samples 30a and 30aa. The levels are 1400mg/kg (30a), and 810 mg/kg (30aa). The proposed MTCA limit for TPH as gasoline is 100 mg/kg, and for TPH as diesel is 200 mg/kg.

Elevated levels of the BETX compounds were detected in sample 30a; however, the concentrations detected are below the proposed MTCA limits. Table 9-1 provides a summary of the analytical results for Terminal 30.

Conclusion

The laboratory results suggest that Tank systems 30a and 30aa have released product to the surrounding subsurface media. Based on the limited information provided to ERM-NW, it is estimated that impairment may extend from 6 inches to a depth of 8 feet below ground surface.

Terminal 106

Site Location

Terminal 106 is located east of East Marginal Way South, north of Southwest Spokane Street, and south of South Hinds Street.

Site Procedures

POS personnel conducted a tank assessment of Terminal 106 on May 11, 1990. The following four tanks were assessed:

- Tank wb- 3000 gallon gasoline tank;
- Tank wc- 1000 gallon gasoline tank;
- Tank wd- 3000 gallon diesel tank;
- Tank we- 5000 gallon gasoline tank.

Tanks wd and we are situated side by side, according to field notes provided to ERM-NW.

One sample was submitted for chemical analysis from Tank wb, two samples were submitted for analysis from Tank wc, one sample from tank wd, and two samples were submitted from Tank we. The analyses performed were for TPH and BETX.

Sample T106wb was a composite sample collected from soil at the base of Tank wb. No ground water was encountered.

The samples from Tank wc were collected from a point about midway down the tank, at an undisclosed depth. The field notes indicate that contaminated soil begins at a depth of about five and one-half feet and continue to the bottom of the excavation. The bottom of the excavation is surmised to be at about eleven feet, based on the field notes from adjacent sites.

The depth at which sample T106wd was collected from the excavation was recorded at eight feet in the field notes provided to ERM-NW. Sample T106wd was collected on the outside of the tank. The notes indicate that diesel stained soil exists from a depth of three feet to the

bottom of the excavation, at eight feet below ground surface. Ground water seepage at a depth of eight feet was noted.

Sample T106we was collected from about eleven feet below ground surface at the base of the tank. An odor of gasoline was noted at this sampling location. Sample T106we2 was also collected from the base of the tank, at a depth of about eleven feet. Sample we2 was collected at the opposite end of the tank from which sample T106we was collected. It was noted that an odor of diesel occurs at this location. A sketch in the notes indicates that stained soil extends from about 2.5 feet below ground surface to at least eight feet below ground surface. Groundwater seepage was observed at about 8 feet below ground surface.

Analytical Results

The analytes TPH and BETX were not detected in sample T106wb.

Both samples from Tank wc (T106wc and T106wcw) yielded TPH values of 730 mg/kg and 210 mg/kg, well above the proposed MTCA limits. These two samples yielded the following levels of ethylbenzene and xylene which are above the proposed MTCA limits:

- T106wc; ethylbenzene 21,000 µg/kg; xylene 110,000 µg/kg;
- T106wcw: ethylbenzene 34,000 µg/kg; xylene 180,000 µg/kg.

The analytes TPH and BETX were not detected in sample T106wd.

The laboratory analysis for samples T106 we and T106 we2 yielded elevated levels of TPH of 1800 mg/kg and 110 mg/kg, respectively. These results are well above the proposed MTCA limits (100mg/kg) for TPH as gasoline. Samples T106 we and T106 we2 yielded trace to low levels of ethylbenzene and xylene.

Table 9-2 provides a summary of the analytical results for Terminal 106.

Conclusions

The analytical data and field observations indicate that the system for Tank wb is not leaking.

The analytical data and field observations suggest that Tank wc and Tank we are potentially leaking underground storage tanks. The thicknesses of impaired soil were noted to be at least 5.5 feet at both tank locations. Impaired soil was noted from 5.5 to 11 feet (surmised) at Tank wc, and 2.5 to 8 feet at Tank we. TPH and BTEX levels are above the MTCA limits at Tank wc and TPH levels are above the MTCA

Terminal 115

Site Location

Terminal 115 is located east of West Marginal Way South and north of South Michigan Street.

Site Procedures

Tank assessment procedures at Terminal 115 were undertaken May 9-10, 1990 by the Port of Seattle. Tank b, a 1000 gallon gasoline tank and Tank l, a 4000 gallon diesel tank, were assessed. Two soil samples were collected from trenches excavated adjacent to the underground storage tanks. One sample from each tank location was submitted for chemical analysis. The analytical data was provided to ERM-NW for review.

Site Conditions

Information provided to ERM-NW for Tank 115l indicates that the soils consist of wet silt and sand. The depth to ground water was not noted nor was the sampling location. No information regarding the soils, ground water, or sampling procedures was supplied for Tank 115b.

The analyses performed were for TPH and BETX for 115l and TPH for 115b.

Analytical Results

None of the above analytes was detected in either of the samples submitted for laboratory analysis. See Table 9-3.

Conclusion

Based on the analytical data provided, neither Tank l or Tank b exhibited indications of the potential to have released product to the surrounding subsurface media.

Table 9-1
Analytical Results for Terminal 30

EPA TEST METHOD 3550/418.1 (mg/kg)

Port of Seattle Sample #	Sample Interval (feet)	TPH[1] Oil & Grease
T 30a	N/A	1400.0*
T 30aa	N/A	810.0*

EPA TEST METHOD 8020 (µg/kg)

Port of Seattle Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
T 30a	260.0	1000.0	2300.0	9600.0

[1] TPH - Total Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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Table 9-2
Analytical Results for Terminal 106

EPA TEST METHOD 3550/418.1 (mg/kg)

Port of Seattle Sample #	Sample Interval (feet)	TPH[1] Oil & Grease
T 106 wd	N/A	ND
T 106 we	N/A	1800.0*
T 106 we2	N/A	110.0
T 106 wc	N/A	730.0*
T 106 wcw	N/A	210.0*

EPA TEST METHOD 8020 (µg/kg)

Port of Seattle Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
T 106 wd	ND	ND	ND	ND
T 106 we	≈350	≈950	≈2000	≈1300
T 106 we2	18.0	ND	12.0	190.0
T 106 wc	ND	22,000.0	21,000.0*	110,000.0*
T 106 wcw	ND	19,000.0	34,000.0*	180,000.0*

[1] TPH - Total Petroleum Hydrocarbons
* These values exceed the MTCA proposed cleanup levels
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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TABLE 9-3
Analytical Results for Terminal 115

EPA TEST METHOD 3550/418.1 (mg/kg)

Port of Seattle Sample #	Sample Interval (feet)	TPH[1]
T-115L	N/A	ND
T-115B	N/A	ND

EPA TEST METHOD 8020 (µg/kg)

Port of Seattle Sample #	Benzene	Toluene	Ethyl-benzene	Total Xylene
T115B	ND	ND	ND	ND

[1] TPH - Total Petroleum Hydrocarbons
mg/kg = ppm
µg/kg = ppb
N/A - Not Available

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